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THE FOOD SUPPLY OF THE FUTURE[1]

FROM various sources we have heard of late warnings of a deficiency in the food supply of the future population of the United States.

Thus President James J. Hill in his address before the Bankers' Association, and more elaborately in his recent article in *The World's Work*, sets forth in striking terms the growth of our population and the present limits of wheat production and predicts a shortage of not less than 400,000,000 bushels by the middle of the present century unless radical improvements in the prevailing methods of farming are speedily inaugurated.

Davenport, in his address at the dedication of Agricultural Hall at the University of Maine, calculates that if the rate of increase of population in the past one hundred years be maintained, the end of the twentieth century will see us with a population of twelve hundred millions, and emphasizes the fact that the agriculture of the future must be enormously productive in order to feed these teeming millions. He says:

> The conditions that have just been discussed will not be temporary and transient; they will be enduring, yes, permanent, and they must be met by a permanent agriculture—a thing the world has never yet succeeded in establishing. No race has ever yet learned to feed itself except at the expense of the fertility of its own or some other country. Other races have come up against this problem and have gone down under it. . . .
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> There is to be, in the very near future, a struggle for land and the food it will produce

[1] Presidential address delivered before the American Society of Animal Nutrition at Chicago, Ills., November 27, 1909.

such as the world has never yet beheld. He who knows where and how to look can see it coming. The African activity among western European nations is a part of it. It is always cheaper to move when over-population and failing fertility threaten a shortage of food—providing there is any place to move into; that is, providing we can dispossess the other party and his land is worth the contest.

However that may be as an abstract proposition, for us there is no moving. For us there are no more "new worlds." For us there is little more "out west." Our fortune and our future, whatever they may be, are staked down on the American continent. Literally, "here we rest," and whether we like it or not, we must devise and establish a permanent agriculture or go down in the attempt.

Much the same general line of thought was followed by President J. L. Snyder in his annual address before the Association of American Agricultural Colleges and Experiment Stations, but with special emphasis on the social significance of a straitened food supply. He said:

. . . agriculture has contributed to democracy more than we can estimate by furnishing our people with an abundant food supply. So fertile has been our land, so extensive our fields, so abundant our harvests of grain and fruit, that the best and highest grades of food have been within the reach of every citizen who has been willing to do an honest day's work. It matters not what his occupation and social position, be they ever so humble. He and his family enjoy practically the same kinds of food as that enjoyed by families of wealth and prominence. In the dinner pail of the man who works in the mill, in the mine, or digs the ditches in our city streets, can usually be found wheat bread, meat, butter, fruit and coffee. What more does any one have? . . .

Caste and class distinction can make little headway among a people who all live on the same kind of food. As long as the working man has in his tin pail as good a dinner as his superintendent or as the mayor of his city, his prejudices will be moderate. He will maintain his self-respect and feel and act the man. It is when the pangs of hunger begin to pinch that men give way to prejudice and passion.

After pointing out that unless the food supply keeps pace with the increase of population, there will not be enough of the better foods to go around, he says:

The history of other countries tells us what would soon follow. Two families could not or would not occupy the same pew in church while one lived on white bread and meat and the other on black bread and potatoes. There is a social distinction there that can not be bridged. They would not even attend the same church or belong to the same social organizations. Our people would separate into classes and become estranged from each other. The power usually goes with wealth, but the men compelled to live on cheap food would soon get into the same political party and perhaps gain control of the national government.

and quotes from a letter of Lord Macauley to an American friend as follows:

. . . The day will come when the multitudes of people, none of whom has had more than half a breakfast or expects to have more than half a dinner, will choose a legislature. Is it possible to doubt what sort of a legislature will be chosen? . . . There will be, I fear, spoliation. The spoliation will increase the distress; the distress will produce fresh spoliation. . . . Either civilization or liberty will perish.

Even if we question the estimates of rate of increase in population on which these warnings are based, and however much weight we may attach on the other hand to estimates of increasing agricultural production per acre, it would be foolish in the extreme to close our eyes to the fact that the intensity of the demand for food by our future population will exceed anything we have yet known. Whether this state of affairs is to come about more or less rapidly is important chiefly as it gives us more or less time to prepare for it.

This is not the occasion to discuss problems of crop production nor of the conservation of soil fertility, but there are other aspects of the question which intimately concern us as stock feeders.

The problem of food supply is essentially

a problem of energy supply. While a small proportion of our food during the earlier years of life serves to build up the bodily machinery, by far the larger part of it is simply the vehicle by means of which chemical energy is introduced into organism, to be liberated again as work or heat in the performance of the vital functions. Briefly and crudely stated, food is the fuel of the body. The ultimate source of this energy, so far as we are concerned, is the sun. Crops are produced by means of solar radiation and food represents the stored-up energy of the sun's rays. The continuance of life upon the earth is conditioned upon the ability of the plant to effect this storage of energy and the density of population which a country can support from its own resources is limited absolutely by the amount of solar energy which can be recovered in the form of food products.

In view of this absolute dependence on solar radiation, it is a rather startling fact that the larger part of the energy stored in an acre of crop is contained in inedible products. From one half to two thirds of the organic matter of the corn crop, for example, is contained in the stover and cobs and about sixty per cent. of that of the average wheat crop in the straw. Furthermore, grain itself is not adapted for direct consumption by man, but undergoes various processes of preparation, giving rise to numerous unavailable by-products. For example, in the milling of wheat, about 25 per cent. of the grain passes into the offals and only 75 per cent. serves for purposes of human nutrition. In other words, out of the total energy stored up by the growth of an acre of wheat only about 30 per cent. serves directly for the nutrition of man. Substantially the same thing is true in greater or less degree of other food crops, while the grasses and leguminous forage crops which play so important a rôle in modern agriculture are, of course, entirely useless as human food.

It is clear that as population becomes denser and agriculture more intensive, it will become essential to utilize the energy of these by-products as completely as possible. When we number 500,000,000 we can not afford to throw 60 per cent. of the energy of the wheat crop into the manure heap if it is possible to save any of it. The agency for effecting this saving is our domestic animals. They are able to consume these by-product materials which man can not use and to render available a portion of their energy, using it in the first instance to support their own lives, but also storing up for man's use a certain part of what would otherwise be a total waste. As the demand for food grows more intense, it will become increasingly important to so husband these by-products and combine them into efficient rations, and to feed these rations under such conditions and to such types of animals, as to save the largest possible percentage of the energy which they contain.

It scarcely need be said that we are still far from doing this. Our rations are too often faulty and fed to inferior animals under unfavorable conditions, and only a short railway journey is necessary to convince one of the enormous waste of forage taking place every year, while our by-product feeding stuffs compete with native products in the markets of the old world.

With our relatively sparse population, this has hitherto been a country not only of cheap food, but especially of cheap meat, and we have been fond of drawing the contrast between the diet of our laborers, with its abundance of animal food, and that of the European laborer, and whether rightly or wrongly, have attributed much of the

greater efficiency of our workmen to this difference in diet. This abundant meat supply has been drawn especially from the vast corn fields of the Mississippi valley. Not only have our by-products gone to waste, but material available as human food has been converted into meat and milk. While this concentration of grain into higher priced and more marketable products has been in the past and to a degree still is entirely justified economically, nevertheless, the conversion of corn, or of any food grain, into meat is an exceedingly wasteful process. Jordan[2] computes that in the production of beef or mutton only about 2⅔ per cent. of the digestible organic matter consumed by the animal is recovered as human food in the edible portion of the carcass, while even in pork production this percentage rises to only about 15½ per cent. Facts like these make it evident that we can not continue indefinitely to use edible grains as stock food—to take the children's bread and cast it to the beasts. The waste of energy in the transformation is too great. Nor is it any answer to say that wheat and not corn is the bread grain of the western world. The irresistible economic pressure of population will sooner or later compel us either to use corn as human food or to utilize the land now devoted to corn culture for other crops which shall yield more available nutriment, while the stockman will be forced to utilize by-product feeds to the utmost, not simply as a means of continuing meat as a prominent ingredient of our diet nor of providing animal foods as luxuries for the tables of the wealthy, but primarily as a means of conserving energy for human use. The feeder of the future will utilize by-product feeds to an extent as yet unrealized. He will pass in review the crude products of the farm, and all the hundred and one wastes of manufacturing operations, to see if perchance they still contain energy which he can extract. Like the miner, he will be ready to work low-grade ore, provided there is a sufficient margin of profit. Even the small amounts of available energy contained in such feeds as oat hulls, corn cobs and the like will be utilized and their waste energy saved as rapidly and as far as economic conditions render profitable, and to aid in rendering this possible is to render service to mankind.

It must be clearly understood, however, that this desirable end is not to be attained by any species of pious fraud. The manufacturers of mixed feeds are of late making much of the importance of by-product materials, a most sound proposition in itself, but one which hardly justifies all the corollaries which some of them appear to draw from it. That corn cobs, for example, contain a certain small amount of available energy does not render it an act of benevolence to induce the farmer to feed them, as Mike wanted his whiskey supplied, "unbeknownst," in some mixed feed with a high-sounding name or as an inconspicuous admixture to some well-known material. Such surreptitious kindness is in danger, in the long run, of recoiling upon its author. We shall not effect the needed economies of the future by coaxing or beguiling the feeder into utilizing these low-grade materials as ingredients of patent feeds or pre-digested mixtures or ready-balanced rations, but by teaching him their true value and educating him to make his own mixtures and balance his own rations. Personally, I am opposed on principle to mixed feeds, as I am to mixed fertilizers, not because many of them are not good of their kind, but for the reason that they minimize the intelligence of the farmer while they open a wide door for fraud on

[2] "The Feeding of Animals," 5th edition, p. 405.

the part of unscrupulous manufacturers and dealers.

The questions which we have been considering are very broad ones. They signify nothing less than a revolution, no less real because gradual, in the methods of agriculture as a whole and of the production of animal foods in particular, and the conditions which we must expect in the future will call for a much higher degree of skill in adapting means to ends than has been necessary in the past. What, then, should be the attitude of the institutions for agricultural teaching and research toward the problem of the future food supply?

Hitherto a large share of our experiments in feeding have had for their chief aim the improvement of present practises. They have sought to demonstrate how we may most efficiently convert grain into meat rather than how much of it can be saved for man's direct use. While such experiments have been of undoubted immediate utility, yet we shall soon have to reverse the point of view. Our experiment stations must take up in earnest the conservation rather than the exploitation of food resources, and our agricultural colleges, while still teaching the approved practises of the present, must as their chief aim seek to equip their students with a sound knowledge of underlying facts and laws and thus prepare them to meet the changing conditions of the future. In passing, too, I can not forbear calling attention to the fact that such an attitude toward the subject of animal husbandry and such methods of teaching it will serve to impart to it a higher pedagogic value than it generally has at present and will tend to make it a disciplinary as well as an informational subject.

Investigation of the questions here outlined must be of as broad and comprehensive a character as the problems to be solved. It should proceed, as I view it, along two main lines.

The first of these is a far more extensive and profound study of the scientific principles of animal nutrition than has yet been made.

That he may utilize the materials of which I have been speaking as completely as possible, the stockman needs to know in the first place what proportion of the energy which these various materials contain it is possible or practicable to recover. This knowledge will enable him to effect a wise selection in the compounding of rations, as well as have an influence upon the whole system of farming. In the second place, he needs to know the relative efficiency of different species, breeds and types of animals as converters of energy and how their efficiency is influenced by their natural or artificial environment.

These, however, are questions of animal physiology. In effect they ask how does the animal mechanism operate when supplied with different raw materials or placed under varying conditions. They are problems for rigorous scientific research and too much stress can not be laid upon the importance of such research. A well-known investigator, in a private communication from which I am permitted to quote, says:

> If we are to find new things, to get new ideas and to establish new lines of practical experimentation, we must first increase our field of opportunity by discovering new facts of general application. The progress of every branch of applied science has been made in this way and agriculture as well as the mechanic arts has shared in the benefits. The immense improvements of recent years in agricultural practise are largely founded on the purely scientific investigation of the preceding generation. The progress of the future must be founded on the scientific research of the present. That researches directed to immediate practical results frequently fail to yield all

that may be expected of them is largely due to the imperfections of the scientific work of the past and so makes evident the importance of undertaking in the present purely scientific studies which will lead to more definite and valuable results when future experiments are directed to the solution of practical problems.

No field of study opens so widely or presents so many opportunities for gaining knowledge of untold practical importance as that of animal nutrition.

As an illustration of the importance of gaining information respecting the fundamental problems of nutrition, the knowledge gained during the last few years respecting the constitution of the proteins may be mentioned.

As a result of these recent discoveries the whole question of protein assimilation is put in an entirely new light, multitudes of new questions are raised which must be answered before the feeding of these substances can be carried out on a scientific and intelligent basis. Heretofore in conducting feeding experiments proteins have been assumed to be of equal nutritive value and no definite evidence has been obtained which shows whether or not this is so. The wide differences in the constitution of the proteins of different animal and vegetable tissues at once raises the question of their relative nutritive value and the best methods of feeding them. Definite information respecting the nutritive value of each of the proteins commonly employed for food can not fail to show the way to new experiments with the use of commercial feeding stuffs and ought sooner or later to show the way to more productive and economical uses of these foodstuffs. A similar knowledge of the actual nutritive relations of phosphorus-containing substances[3] would likewise doubtless lead to similarly important results and deserves far more attention from a purely scientific standpoint than it has yet received.

Concerning all these questions we know something, but how little this is in comparison with what remains to be discovered. These are hard problems but they must be solved, before agricultural practise can have the benefit of what science can do for it.

Such work is intensely individual in character. The prime factor is the man. The principal service, and a highly important one, which an organization can render is to aid in providing the opportunity. Such service I earnestly hope our society may be able to perform, especially in the direction of impressing upon public sentiment as represented in legislative bodies, on the one hand, and upon the minds of benevolent men of wealth, on the other, hand, the fundamental importance of scientific research for the successful solution of the problem of the future food supply.

The other main line of experimental effort relates to the economic application in practise of the principles discovered by scientific investigation. Along this line, as I see it, there is a wide field open for fruitful experimental work, but this aspect of the subject was so fully dealt with last year in the report of the committee on organization that it seems superfluous to enter into it anew at this time.

Finally, along both lines of effort, but especially the second, there should be a coordination of effort and of spirit combined with the largest possible scope for individual initiative. This society owes its origin largely to a feeling of dissatisfaction over the more or less fragmentary and elementary nature of our past work. The discussions of the Cornell conference and of the last annual meeting of the society, as well as the incorporation into its constitution of the provision for a committee on experiments, clearly shows a desire on the part of investigators for closer relations with each other and a more broadly conceived program of investigation. It is hoped that the meetings of this society and the work of its committee may at least be serviceable in defining problems and improving methods.

But no program of agricultural investigation can be truly national in its scope which does not include the greatest agricultural agency perhaps in the world—

[3] The experiments of McCollum, at the Wisconsin station, published since this was written, are most important on this point.

certainly the predominant one in this country—the United States Department of Agriculture. No one would think of intimating that this great department has neglected the interests of the stockmen of the United States, but nevertheless, it is true that until very recently its work for them has been chiefly of the nature of veterinary and inspection work, as indeed it still is to a relatively large extent. The Bureau of Animal Industry has, it is true, established a dairy division and has begun to take up problems of feeding and especially of breeding with the modest appropriation for this purpose which congress has put at its disposal. The department should be put in position to do much more than it is doing, however. Its work in this field should be productive as well as protective. If the development of our waterways and the conservation of our forests, mines and water powers are subjects of national concern, surely the conservation of the food supply is worthy of attention. The magnitude of the live stock industry in itself, and especially its important relations to the future food supply of the nation which I have been endeavoring to point out, are such as to amply warrant the department in entering upon comprehensive investigations, both scientific and practical, into this subject and to fully justify congress in making all necessary appropriations. It is not alone our food supply, but our democracy, which is at stake.

It goes without saying that such an effort on the part of the national government should be made in harmony with the investigations which may be undertaken by other agencies. All the available forces should unite in the study of these important questions and no local jealousies should be allowed to stand in the way. While there may be problems of coordination and correlation still to be solved, I am confident that they are readily solvable, while it seems not impossible that in some respects this society might advantageously serve as an unofficial intermediary between state and national authorities.

I congratulate the society upon the notable increase in its membership during the past year and upon the very encouraging attendance upon its first annual meeting. If I understand the spirit and temper of its members, they desire to make the society something more than a pleasant club or a gathering for the reading of papers. It is my hope, which I believe I share with every member, that it may become an active agency in forwarding the solution of some of the problems which I have attempted to indicate in this address.

H. P. ARMSBY

A DEFENCE OF SANITY[1]

EVER since the reign of the illustrious Emperor Augustus, when Horace taught that all men are mad, there has been a wide-spread belief in the truth of the Roman poet's assertion. Yet few of us are wholly mad, and we shall not go far astray if we agree with a modern essayist that "every man has a sane spot somewhere." The actual degree of insanity from which any one of us suffers is a matter difficult of determination, since it can be made known only through the verdict of one's peers, who themselves in turn are demented. One can arrive at a correct judgment in an individual case only by comparing it with that which the most intelligent of the multitude, after long study and deep knowledge, have established as the norm. Any pronounced diversion from

[1] An address delivered at the opening of the fifty-seventh year of the College of Medicine of the University of Vermont, Burlington, November 3, 1909.

the teachings of the masters, unless there exist logical and credible grounds for diversion, stamps its possessor as one who is, in so far, without the pale of those who know.

But why should any one be without the pale? There is a wide-spread idea that the greatest evil in the world is ignorance, that education is its antidote, and that, with learning made easy, sanity and temperance and all things of good report will be the lot of mankind. While this represents obviously an extreme view, it is probably applicable to the majority of men in their relation to the majority of things. But biologists are agreed that what a man is is the result of the action of two forces, heredity and the environment, nature and nurture. While an educational environment may conduce to sanity, a man may, on the other hand, be handicapped by an ancestral perversion, which all the education in the world can never overcome. But the difficulty is further increased by the fact that the norm is ever changing, and, indeed, must ever change if the world is to progress. It follows, therefore, that the insanity of to-day becomes the sanity of to-morrow, if we are clever enough to bring the world around to our way of thinking. Stevenson said: "Give me the young man who has brains enough to make a fool of himself"—but it was the brains and not the fool that Stevenson really wanted.

In meditating much on the question as to the sphere in which human abnormality is most pronounced, I have come to believe that it is in beliefs and practises relating to the human body in health and in disease. And since the study of the human body in health and in disease is to be your life work, and since it will be your fate to come into intimate contact with many of these beliefs and practises, it has seemed to me fitting to devote the hour at my disposal to a consideration of some of them.

Before you leave these halls to practise your profession you will come to know that there has grown up in the course of many centuries an enormous mass of knowledge, for the most part well-ordered and rational, which constitutes the medical science and art of to-day. It is the contribution of many superior minds of all the world's ages. Some of its truths were known to the early Greeks, and from them down to the modern laboratory and clinic it has received a continual stream of accessions. But it is not accession only that has taken place, for to a large extent there has occurred a process of selection, a rejection and replacement of what has proved unsuitable, so that the medicine of to-day represents the survival of the fittest. Though the sifting process continually goes on and though everywhere there are points in dispute and unsolved problems, there yet exists the great fund of accepted medical knowledge, constituting a standard, according to which individual opinions concerning the body in health and disease are to be judged. It is convenient to classify this mass of knowledge, and so we recognize the specific divisions, not altogether sharply separated, such as anatomy, physiology, hygiene, bacteriology, pharmacology, therapeutics, surgery and neurology. In so far as one believes in the accepted principles of any one of these divisions he is pronounced by his fellows therein sane: in so far as he rejects them without adequate reason, he is looked at askance and with suspicion. And so it is with regard to specific matters within any one of these divisions. Obviously the amount of knowledge that the layman possesses of these various branches of medicine can be only small. The man on the street is pitifully ignorant of his own body

in health and disease, and even more ignorant of the rise and present stage of development of the science and art of medicine. Largely because of this ignorance he is prone to grotesque opinions and statements. Such opinions are not, however, confined to the man on the street. A famous university professor, whose studies lie rather in the sphere of a dead language than of a living science, said recently to a colleague, in explanation of a slight attack of faintness, that the fumes of his gall had passed upward into his brain! The students of the first medical year now before me will soon learn to appreciate the strangeness of this physiological conception.

Most persons are eccentric to a greater or less extent on the subject of diet. Their notions of food, what they can eat and what they can drink, are often derived from a very crude kind of illogical deduction from their experience. To pounce upon a single unhappy food as the cause of an attack of indigestion after a feast, and pledge oneself to abstinence from it in the future, when there might be a score of causes, not only constitutes wilful defiance of the laws of logic, but it is never certain of insuring immunity from a subsequent similar attack of gastric disturbance. No one is free from imagined dietetic peculiarities, and there are differences only of degree between successive individuals in the dietetic series from the omnivore at one end to the vegetarian, the fruitarian, the nutarian and the raw-food advocate at the other. Of all these extremists perhaps the advocate of raw food is the most mad, for his sober contention is that if food be eaten in the uncooked state, its protoplasm on entering the body will at once be added, by a sort of accretion process, to the stock of protoplasm of the host! Such a simple, clear, attractive generalization has but one fault, that it fails to take into consideration the physiological phenomena of digestion, absorption and assimilation. While some persons are thus quarreling as to the kind of food that human beings should eat, others are discussing the quantity of food. There is undoubted soundness in Chittenden's main conclusion, supported by carefully conducted experiments, that most persons customarily take too much food, and his influence will undoubtedly conduce to ultimate good in inaugurating greater temperance in eating. Probably to most persons in the past, where food has been abundant, eating has been in large part a matter of sensuous indulgence. Greater sanity in this respect is surely being inaugurated, just as it has already been inaugurated in the matter of drinking alcoholic liquors.

Diet, however, constitutes but one sphere in which we all have our unreasoning personal hobbies. The character of one's domestic remedies for slight physical ills is also an indication of one's mental trend. The soothing syrup, hot drops, composition and catnip tea of our well-intentioned grandmothers, and the various messes, for the most part harmless, which were employed for the annual spring house-cleaning supposed to be required by the blood, were succeeded by the long list of proprietary or "patent" nostrums, many of which, it is now known, owed their popularity to their unsuspected content in alcohol; and these in turn are giving way to the more rationally prepared drugs of the pharmacopœia. But some persons like to think that the day of the drug has passed, and the drug-giving doctor is often held up to ridicule. Such persons, and happily they are few, are seemingly ignorant of the fact that at no time has the science of the drug ever been so exact as now; the physiological actions of drugs

were never so well known; the methods of their preparation and standardization were never so perfect; and their therapeutic use was never so effective; while the discovery of new drugs has greatly widened the range of their applicability in disease.

The subject of drugs leads us naturally to consider other methods of healing. In these amazing days of rapid living, when we rush over the earth's surface or through the air above or the waters beneath, when we joyfully jaunt to the icy ends of the earth's axis, or speak our messages straight into the wireless ether, confident of their destination, we are prone to become impatient with long-existing things—we are ever seeking the novel. With the seemingly slow progress of the difficult science and art of healing disease it is not strange that unorthodox methods of healing should have come into much favor. Medicine is not really making as slow an advance as often appears to the layman. The past quarter of a century has witnessed the rise of an entirely new and powerful medical science, bacteriology, and a series of brilliant onslaughts, which are certain of ultimate success, against that great enemy of mankind, the infectious diseases. As instances of what has been accomplished already one needs only to recall here the remarkable decrease in the death rate of diphtheria and tuberculosis. The success in surgery during the same period has been scarcely less brilliant. Internal medicine, fortified by great physiological and pathological discoveries, is rapidly forging to the front; while there is no considerable class of diseases in the knowledge and treatment of which progress has not been marked. Yet notwithstanding the hopeful augury, many men and women are dissatisfied with the results and the prospects. Nothing testifies so well to the tendency of humankind toward the bizarre as does the spread of osteopathy and Christian Science. In the foundations of both of these cults there can be found a few grains of scientific truth, but they are surrounded and concealed by such a fabrication of the false, the imaginary and the superficial, and the whole is often so exploited by ignorance and deception, that it would seem as if the normal mind must turn from them in disgust. Yet the mystery about them charms; and multitudes of otherwise worthy men and women are attracted by them and cheerfully give to them their own souls and bodies and the souls and bodies of their children.

Osteopathy is an outgrowth from the primitive conditions prevailing on our western frontier in the period preceding our civil war, when educated physicians were few, opportunities for rational treatment were fewer, and boldness in assertion and action counted far more than exact conformity to scientific truth. The founder of osteopathy was one of the rude, itinerant practical bone-setters, probably often clever in his attitude toward the sick. Though unlettered, he was possessed of a positive philosophy that found a sympathetic hearing in the home of many an unlearned frontiersman, who would have been ill at ease under the ministrations of one trained in the nice theories of academic medicine. Osteopathy was and still is full of unfounded assertions regarding the normal functioning of the bodily structures, and the nature and proper methods of cure of disease, though of late years its more enlightened practitioners appear to be endeavoring to harmonize its practises with certain accepted scientific principles. It speaks much of "lesions," by which it means, not the commonly accepted pathological idea of morbid changes, but rather "any structural perversion which by pressure produces or maintains functional

disorder." Of all parts of the body subject to lesions the spine is of fundamental importance, and "it is only in occasional cases of disease that no treatment is given to it." Treatment consists chiefly in correcting the structural perversion by manipulation with the hands and thus removing the pressure on the functionally disordered organs or on nerves or blood vessels supplying them. The osteopath serenely, with a single stroke of the hand, waves away the facts of scientific pathology. Says the prophet:

> I have concluded, after twenty-five years' close observation and experimenting, that there is no such disease as fever, flux, diphtheria, typhus, typhoid, lung-fever or any other fever classed under the common head of fever. Rheumatism, sciatica, gout, colic, liver disease, nettle-rash or croup, on to the end of the list of diseases, do not exist as diseases. All these, separate and combined, are only effects. The cause can be found, and does exist, in the limited and excited action of the nerves only, which control the fluids of parts or the whole of the body.

The cause of all diseases is "a partial or complete failure of the nerves to properly conduct the fluids of life." One can with difficulty suppress a feeling of admiration for the audacity with which time-honored scientific facts and principles are thus put aside. Osteopathy undoubtedly effects cures, but so does the medicine man of the savage tribe.

The founder of Christian Science prefaces her remarkable book with the words of Hamlet: "There is nothing either good or bad, but thinking makes it so." She does not seem to have been aware that these words were spoken at a time when Hamlet was strongly suspected of being out of his head, and when his actions and utterances seemed to justify such a suspicion. If osteopathy is presumptively assertive, Christian Science is no less so. Its founder avers:

> The cause of all so-called disease is mental, a mortal fear, . . . a fear that mind is helpless to defend the life of man and incompetent to control it.

The cure of all disease is equally simple:

> Through immortal Mind or Truth, we can destroy all ills which proceed from mortal mind. . . . We can not obey both physiology and Spirit, for one absolutely destroys the other, and one or the other must be supreme in the affections. . . . Fevers are errors of various types. The quickened pulse, coated tongue, febrile heat, dry skin, pain in the head and limbs, are pictures drawn on the body by a mortal mind. . . . Destroy fear and you end fever.

Of hay fever it is said:

> It is profane to fancy that the perfume of clover and the breath of new-mown hay can cause glandular inflammation, sneezing and nasal pangs.

There is no "ancestral dyspepsia":

> If a random thought, calling itself dyspepsia, had tried to tyrannize over our forefathers, it would have been routed by their independence and industry.

The Christian Science disciple asks this question:

> Should all cases of organic disease be treated by a regular practitioner and the Christian Scientist try truth only in cases of hysteria, hypochondria and hallucination?

The answer is not ambiguous:

> One disease is no more real than another. . . . Decided types of acute disease are quite as ready to yield to Truth as the less distinct and chronic form of disease. Truth handles the most malignant contagion with perfect assurance.

Philosophers have pointed out the crudities, contradictions and confusion of thought in the metaphysics of Christian Science. It is interesting to look over the long list of achievements of which it boasts, for they include, among others, the cures of cancer, fibroid tumor, astigmatism, epilepsy, tuberculosis, rickets, hernia, valvular disease of the heart, measles, asthma, Bright's disease, dropsy, croup, tonsilitis and a bad temper. Moreover, it is claimed

that by the same method broken bones have been instantaneously healed and the lost substance of disintegrated lungs has been restored. These wonders have been accomplished largely by the simple reading of Mrs. Eddy's book. But, however incredible may appear many of these so-called cures, what of the failures, what of the suffering and misery and death that might have been prevented? If scientific medicine, with all the skill which it can command and the hope which it can give to suffering humanity, often fails to justify its promises, what can be said of a would-be healing system which employs only the grotesque fantasies of a shallow mind? If Christian Science occasionally confers upon its believers a certain degree of cheerfulness of spirit and obliviousness to the petty annoyances of daily life, it numbs the senses and the courage and does not make the world's fighters. It is a lamentable fate for a child to be educated to a belief in such a debilitating panacea.

The same criticism can be made, in even stronger terms, of various minor kinds of mental or psychic healers, though here charlatanry is even more blatant. Many of these healers employ successfully the method of absent treatment. Even Mrs. Eddy says: "Science can heal the sick who are absent from their healers, . . . since space is no obstacle to Mind." The employment of absent treatment has received a considerable impetus with the advent of the telephone. How simple a matter it now is to ring up the healer in the depths of the night and request him to treat one's crying child from the recesses of his office a mile away! The credulous mother feels that something is being done for her suffering babe, even though the healer at his end of the wire merely turns over in his bed for another nap, having made a mental note of a fresh charge to be entered in his account book on the morrow. This picture is not overdrawn—its like may be seen any day in our cities.

It is a long step from such healers to the psychotherapist of the better class of the present day. In turning to psychotherapy I would have it understood that I speak of this subject in its broader applications. There is a notion, wide-spread in this country, which limits the term to the particular healing movement that was initiated at Emmanuel Church in Boston and has since extended to a few other churches. However instrumental this church movement may have been in arousing popular interest, the psychic method of dealing with disease is no new method, either in this country or abroad. The psychotherapist is an enlightened man, who recognizes and respects the achievements of scientific medicine, and if he is not a doctor of medicine himself he works hand in hand with the doctor of medicine. He makes no pretence that psychotherapy is a panacea, he simply claims that it is a valuable supplement to the physical agencies commonly employed by the physician, and is useful in certain so-called functional diseases of the nervous system. It is a mistake, I believe, to draw, as he does, a sharp distinction between organic and functional nerve diseases, the former being accompanied by morphological changes in nerve structures, the latter not being so accompanied: for I can not conceive the existence of a disease involving function without some physical abnormality. It is a mistake too, I believe, to assume the existence of a subconscious mind through which the psychic influence is mediated: for the phenomena which are now often relegated to the subconscious are capable of explanation without going beyond the sphere of physiology. The psychotherapist does not rely upon supernatural forces, he employs

the same agent that the hypnotist, the teacher and the parent employ, namely, suggestion, of which we all make daily use in our dealings with our fellows. If he couples with it the self-surrender involved in Christian faith, it is because he believes the mental attitude thus induced to be, with many persons, helpful in making suggestion efficacious. But I take it that religious faith is not the essential factor. The psychotherapist himself is, or at least tries to be, reasonably sane. It is his patients and his would-be patients who often make extravagant demands on, and hold extravagant beliefs in, his powers. That his method is effective in a limited variety of diseases and in a certain proportion of cases seems to be beyond question. But that it is not of wide applicability as a therapeutic agent and that it is efficacious only in certain hands is equally true. The danger of psychotherapy is twofold: There is, first, the possibility of its practise by ignorant and unprincipled persons for ignoble purposes; and secondly, while it endeavors to make the weak morally strong, it may, like christian science, have the reverse effect. It can be employed with the greatest prospects of success by intelligent physicians, though in addition to a high training in the principles of scientific medicine, they should have a right understanding of human psychology, and should possess a high degree of sympathy with suffering mankind, coupled with a genuine, earnest desire to relieve distress.

It may safely be assumed that, with few exceptions, any one who publicly professes to be opposed to what the consensus of the world's best judges favors, is either mentally or morally deformed. The world can advantageously dispense with the services of those who are constitutionally in a chronic state of opposition to the public weal. There are two interesting aberrant types of humanity, of this negative nature, who constitute themselves a public annoyance and a public enemy. I refer to the antivivisectionist and the antivaccinationist. While claiming the right to be arbiters of scientific method, they are out of sympathy with scientific ideals, suspicious of scientific motives and ignorant of scientific achievements. They are swayed, not by calm reasoning, but by feverish emotion. They either blindly can not, or willfully will not, see that if their demands are acceded to, pain and sorrow and death that might have been avoided will be brought to thousands of their fellowmen.

Nothing is more certain than that scientific experimentation on animals constitutes the very basis of physiological, pathological, medical and surgical advance. To question its value in scientific progress is as futile as to question the value of the railway or the telegraph in commerce. To assert that it is synonymous with the infliction of pain rests upon gravely mistaken assumptions regarding its procedures. To abolish it or fetter it by legislation would change our hopefulness of future victory over hitherto unconquered diseases into despair, and deprive future generations of the blessings which we believe we or our successors can give them. And yet there are persons who would not hesitate to abolish animal experimentation summarily were they given the power. Others, seemingly normal-minded in many respects, would seriously restrict it. And for what reason? Because of an overwrought emotionalism, a hyperesthesia regarding the possible sufferings of animals, a state of things in the laboratories that is wholly fancied, and an unwarranted distrust of the humanity of man. I have had occasion, during recent years, in defending the moral right and even duty of com-

petent persons to endeavor to benefit mankind through experiments on animals, to examine in some detail the writings of some of the leaders in the present outbreak of antivivisection sentiment, both in this country and in foreign countries, and I have been forcibly impressed with the low intellectual and moral tone therein displayed. Some of its writers frankly confess—and this is not exaggeration—that were it a question of the life of the animal or the human being, they would save the former—a sentiment the abnormality of which needs no comment. If the antivivisectionist is ignorant of what actually goes on in scientific laboratories, he has no moral right to inveigh against the method of animal experimentation. If he takes the rare position of doing so with full knowledge, he excludes himself from the multitude, who believe in the beneficence of science and put their trust in those who follow her lead. It is idle to maintain that the man who has the high-mindedness, the intelligence, the patience and the skill to perform the scientific experiment, needs the threat of a penal conviction to teach him obedience to the principles of common humaneness. The antivivisection movement is the least worthy and commendable of all movements that profess to be uplifting, and it is only those whose sense of moral proportions has become askew, who enter actively into it. For you who are soon to become practitioners of medicine it is a duty which you owe to your profession to instruct your patients concerning the methods and the value of animal experimentation and to influence them to maintain toward it an attitude of sanity.

To deny the value of the remarkable discovery of Jenner, now with more than a century's evidence in its support, and with recent allied discoveries confirming its scientific significance, is merely wilful. Yet a well-known writer concludes an extended discussion of the subject with these words:

> That vaccination is a gigantic delusion; that it has never saved a single life; but that it has been the cause of so much disease, so many deaths, such a vast amount of utterly needless and altogether undeserved suffering, that it will be classed by the coming generation among the greatest errors of an ignorant and prejudiced age, and its penal enforcement the foulest blot on the generally beneficent course of legislation during our century.

It is interesting that in the same volume the author utters a long lament over the neglect which the world has given to phrenology, and prophesies that in the coming century "it will prove itself to be the true science of mind." The author of these remarkable pronouncements, Alfred Russell Wallace, made important contributions to science during his early life, but there is a sad intellectual contrast between his discovery, announced coincidently with that of Charles Darwin, of the principle of the origin of species through the agency of natural selection in the struggle for existence, and his indefensible stand, sixty years later, regarding vaccination and phrenology.

Opposition to vaccination is not new. Even in the days of Jenner its opponents are said to have claimed that its tendency "was to cause bovine characteristics to appear in children: that they developed horns, hoofs and tails, and bellowed like cattle." The objections of recent years have been less picturesque, and have been confined largely to a denial of the efficacy of vaccination in the prevention of disease and the saving of life. Reliable statistics from communities where vaccination has been compulsory and has been rigidly enforced clearly disprove this claim. Thus, it is said on authority that in recent years the mortality from smallpox in France, where there is only a partial and

imperfect vaccination law, has been from ninety to one hundred times greater than in Germany, where vaccination is strictly required. During the Franco-Prussian war the French army lost 23,400 men by death from smallpox, and the German army only 450. In the greater city of New York, with its estimated population of over 4,000,000, and in which vaccination is rigidly performed, there were but nine deaths from smallpox during 1907, although one hundred years ago the disease was one of the great scourges. As a companion picture, the well-known case of Montreal in 1885 is strikingly instructive. During a period of several years vaccination had been neglected. Then a single individual, a Pullman car conductor, traveling from Chicago, brought the disease into the favorable locality. An epidemic swept over the city, and caused the death of 3,164 persons within nine months. It is much to be feared that this case will be paralleled with even more direful results in England, where, through the efforts of antivaccinationists, the soil has become well prepared. The antivaccinationist often denies the germ theory of disease, and objects to the whole modern treatment of infectious diseases by antitoxins, serums or vaccines, saying that they are poisons, and that the proper preventives of the diseases in question are cleanliness, pure air and sunlight. Poisons, cleanliness, pure air and sunlight are, indeed, magic words, and yet the microbe is a reality, not a theory. If cleanliness, pure air and sunlight—and what is more expensive for the masses?—have not availed, and the microbe has entered or threatens to enter the body, shall we leave him free to kill? Antitoxins, serums and vaccines are not empirical or artificial remedies; they are nature's antidotes to nature's poisons, and in this respect ought to be classed with cleanliness, pure air and sunlight.

While speaking of some of these fads and foibles of aberrant mankind, I am tempted to say a word about our greatest popular educator, the newspaper. Unfortunately, our newspapers, with few striking and commendable exceptions, are pronounced derelicts in the dissemination of sound scientific and medical ideas. With men of science, trained in sobriety and accuracy, "newspaper science" has become a synonym for the grotesque, the ridiculous, the sensational and the inaccurate. A justification of this on the ground of unavoidable reportorial haste is not to be accepted, nor can I sympathize with the policy that makes an assumed popular desire the excuse for filling the columns with that which is untrue and fantastic. Laboratories, clinics and hospitals are daily productive of serious discoveries, many of which are of inestimable value to the welfare of mankind and, if considered merely from the journalistic standpoint, are of great interest as matters of news. Yet the man on the street rarely finds these mentioned in his daily paper, although he has abundant opportunity to learn of the frivolous and the sensational. With such instruction, we can not always blame him for his beliefs. The newspaper might, if it would, become a great power for good in spreading correct information regarding scientific and medical facts and wholesome ideas regarding scientific and medical theories.

The final topic of which I shall speak is one that concerns the attitude, not so much of the public as of yourselves as practising physicians. The training of a physician is one which should inculcate in him the general principles of sanity and good judgment. Without going in detail into the qualities that make a physician professionally successful, I would urge upon you the very great importance of one thing, namely, correct diagnosis. Avoid

hastily, ill-considered diagnoses. If you find the stomach not performing its functions properly, your first thought will be to treat the stomach, and yet such a procedure might be useless, for the stomach may be affected only secondarily. Among civilized peoples there is constant communication between separated individuals or communities, and the one is constantly influencing the other. This influence may be performed by the aid of two mediums: by the written, spoken or telegraphed message, and by the transmission of material things, such as food, clothing, luxuries, or the thousand things upon which our lives and actions as civilized beings depend. Thus, while members of human society, we are not free, independent agents, each individual living his life in isolation from his fellows. The conditions are similar within a complex organism like the human body; there too no part is independent of the other parts. The correlation between the various organs of the body is a topic that is now looming large above the horizon of physiological discovery. There are two ways in which one organ is capable of influencing another: through nervous impulses and material substances. Nervous influences have long been recognized, but influence through the action of material substances constitutes a comparatively new subject. It is now known of several organs that they manufacture chemical substances, which exert characteristic physiological actions on the cells of other organs. Thus the acid which is formed by the glands of the stomach, and is essential to gastric digestion, acts upon the sphincter muscle at the plyorus in such a manner as to cause it to relax and open a passageway into the duodenum for the digested gastric contents. Once arrived within the small intestine, the acid then causes a contraction of the sphincter, which prevents the return of the chyme. But the duties of the acid are not yet completed. It proceeds to stimulate the epithelium cells of the lining wall of the small intestine and makes them produce a characteristic substance, recently discovered and called secretin. This passes from the cells into the blood-stream and takes two paths: one to the pancreas, where it stimulates the pancreatic cells to secrete their characteristic digestive juice; the other to the liver, the cells of which are similarly stimulated to produce bile. Any interference with the production of acid in the stomach may thus interfere with a whole train of physiological processes which are dependent upon it. Adrenalin, a peculiar chemical substance formed by the adrenal bodies, which in recent years has become valuable to the physician because of its extraordinary power of constricting blood vessels, acts normally within the body upon the whole sympathetic nervous system, and thus influences the various important organs supplied by the sympathetic nerves. There is much reason for believing that intimate relations exist, through the action of chemical substances as yet obscurely known, between the adrenal bodies, the pancreas, the thyroid, the liver and perhaps the heart and the stomach. But if the mutual relations of normal organs are so involved, it is easy to see how intricate the situation may become when an organ becomes diseased, and how difficult for the physician may become the problem of locating, from the assemblage of symptoms, the primary seat of the trouble. That the problem is not necessarily hopeless of solution is demonstrated daily by clever diagnosticians. One can not help having a profound admiration for the man who, armed with an intimate knowledge of nerve centers and nerve tracts, will from certain obscure paralyses specify the exact spot in the course of the tangled nervous system

where an offending tumor lies. My present purpose, however, is not so much to impress you with the difficulties of making a sane diagnosis, as to caution you against the making of an insane one. An ill-balanced judgment in diagnosing disease is one of the commonest faults of the physician, and if the nature of the disease is not discovered, the success of the treatment is not even problematical.

The moral of my tale is quickly drawn. It is, first of all, for you, who are to become healers of the sick, to be sane. It is for you diligently to seek after the truth, and, having found it, to follow its teachings. But you can do more than this, and it is your duty to do more. With your training and with your growing experience, your opinion in matters of health and of disease, in whatever pertains to the human body, will be sought and will deserve respect if that opinion is in accord with what learned men have declared to be wisdom. You will thus be called upon to be mentors and teachers. I plead, therefore, not only for sanity in your own beliefs and practises, but for the constant exercise of your enlightened influence toward the eradication of what has pithily been called "pestilential nonsense" from the minds of your patients and your fellow-men. Swayed by sentiment, they will often seek the bizarre, the foolish and the delusive. "The time will come," said a wise man, "when they will not endure the sound doctrine. . . . They will turn away their ears from the truth, and turn aside unto fables." They will hold to their opinions with the tenacity that is born of ignorance. Montaigne has said that "nothing is so firmly believed as that which a man knoweth least." You will have many opportunities to show to the world that the way toward strange gods is not the way of salvation. You should hail the chance of thus becoming missionaries of common sense to those less well equipped than you. May you make good use of your education and your powers, and, both as physicians and as citizens, always stand as staunch defenders of the gospel of sanity.

FREDERIC S. LEE
COLUMBIA UNIVERSITY

ANTON DOHRN, FOUNDER AND DIRECTOR OF THE NAPLES AQUARIUM

ANTON DOHRN, founder and director of the Naples Zoological Station, or, as it is more popularly called, "The Aquarium," died in Munich after a protracted illness, on September 26. His death severed one more link which connected the present generation with a group of great men, most of whom were his intimate friends, Darwin, Huxley, Virchow, DuBois-Raymond, Helmholtz and Pasteur. The story of his life is of special, no less than general, interest to Americans. Idealism rendered effective through the will and creative genius is the mark of an unusual combination of mental traits and that, in brief, was the keynote of his personality.

Anton Dohrn was born at Stettin in the year 1840. His father, a man in affluent circumstances, was extremely solicitous that his sons should fully appreciate the responsibility attaching to the possession of wealth; and the paternal admonition to the younger Dohrn to choose his own profession provided it was not a money-making one, proves that the form of idealism of the son, to which he always remained true, was in part, at least, inherited.

Those who had the privilege of knowing Professor Dohrn were greatly impressed, not only by his remarkable versatility, but by the great capacity he displayed in dealing successfully with men and affairs. His power to administer and direct the organization of a large institution never seemed to diminish his interest in, nor his ability to carry on scientific investigations of great importance. Honored by the personal friendship of the German Emperor, and received as a not infrequent guest by families of the greatest distinction in Europe, he never permitted the

orderly simplicity of his daily life to be disturbed by outside influences. Goethe's words emphasizing the necessity of plain living as essential to high thinking were constantly on his lips, and he furnished an excellent example of the simple life so often the subject of sermons, and so rarely practised.

Apart from his remarkable personality, there is a reason why Dohrn's life should be of particular interest to Americans, and that is the influence he exerted upon men who were actively identified with all progressive movements in institutions of learning. Shortly before his death the writer had the privilege of spending some time in the company of the late Mr. Daniel C. Gilman during his visit to the Naples Aquarium, and it was extremely interesting to notice the keen and appreciative interest he took in the work of the investigators then engaged in carrying on their studies in the laboratories. "Dohrn," he said, "was one of the first men whose advice I sought for on being elected to the presidency of the Johns Hopkins University, and when I asked him what he considered to be the really essential principle to be kept constantly in view in outlining the policy of a new university, he replied: 'Liberty! Liberty! Liberty!' and added: 'First get the best available men as professors, and do not spend too much money on buildings.'" The advice was not disregarded, for not only were the buildings of the Johns Hopkins University characterized by great simplicity in structure, but the motto selected for the university was "*Veritas vos liberabit.*" Dohrn's guiding principle in establishing the aquarium was to gather about him a body of investigators, and then to enlarge the institution so as best to meet the needs of these workers.

Many Americans carried away from Naples pleasant memories of a day spent on the *Johannes Müller,* the small steamer which made frequent excursions to different points about the Bay of Naples, either to collect specimens for exhibition in the aquarium, or for study by those engaged in scientific investigations. One of the most interesting features of these trips was the opportunity of listening to the story of the founding and development of the zoological station as it was told with almost boyish enthusiasm by Dohrn.

Scientist by profession, he had many of the temperamental qualities of the artist. If he had not possessed this rare combination of mental traits, his friend Joachim would not have put Dohrn's favorite Neapolitan "Fisherman's Song" to music and sent the score to Oxford, to be played at the ceremonies attending the conferring of an honorary degree upon his friend by the English university; nor would Hans v. Marée have asked to be allowed to decorate the walls of the library in the aquarium with a series of frescoes, which are considered by art critics to represent the best work of that artist.

Dohrn firmly believed in the unity of all forms of knowledge. He contended that men should not be classified arbitrarily as "scientists," "artists" or "litterateurs"; as individually they possessed but in varying degrees the temperamental qualities common to all. To lay stress upon these artificial divisions was to return in spirit to the period when classification and systematization were considered of more value than the actual study of vital facts.

Discussions as to the relative merits of science, art or literature failed to interest him, for he felt deeply that life in its broadest sense was for each individual the chief interest; the only essential difference was discoverable not in the object, but in the angle of vision of the observer.

His taste in literature and art was distinctly classical. Cicero, Horace, Shakespeare and Goethe were his favorite authors, selections from Beethoven, or Mendelssohn and Brahms the music he enjoyed the most. In pictorial art, color appealed to him more than form. Perhaps in this he had been influenced by his friend Böcklin. The whole scheme of organization of the aquarium revealed the broad sympathies of the man.

One of the chief reasons assigned for the selection of Naples in 1872 as the best place in which to place the station was the beauty and historical associations of the city and its

surroundings. These two factors Dohrn considered to be of the greatest importance in indirectly influencing the character of the work to be undertaken.

The events of the past year have proved how fortunate it was that Naples, and not Messina, as was originally intended, should be the site of the aquarium.

In the organization of the aquarium the university idea was developed to a degree never before practically realized. In practise as well as theory this was an institution of learning as distinct from teaching. Here are gathered together at one time as many as seventy or eighty representatives of the leading universities of the world; professors, assistants and occasionally undergraduate students, all engaged in carrying on investigations. (The expenses of the zoological station are in part defrayed by money received from the sale of entrance tickets to the aquarium, and in part by the subvention of different countries. Germany pays for 22 places in the laboratory, Italy for 9, the United States for 5, England for 3, Russia 4, Austria 2, Hungary, Holland, Belgium, Switzerland and Roumania each 1.)

Here zoologists, chemists, anatomists, physiologists, pathologists, practising physicians and professional philosophers are all intent upon the study of various problems, the solution of which will eventually throw more light upon the origin and nature of the vital processes in the lower organisms, and consequently and ultimately in man. Thoroughly imbued with the spirit of Darwin, Dohrn long ago realized that the only successful way to understand the complex phenomena of human life was to begin by studying the simpler manifestations in the lower animals. The continuity and similarity of the life processes in the whole scale of animal life is unbroken. "You scientists have little understanding of history," complained Mommsen; "Why assume," retorted Dohrn, "that history begins and ends with man's appearance on the earth? Here in the aquarium we are interested in ancient history, for here we study man's ancestors."

From the crest of the mountains back of Sorrento, turning to the south, one looks down upon the Gulf of Salerno, on whose shores for centuries stood the most famous medical school of medieval times, where were gathered from the shores of Africa and Europe the most renowned students of their day. To-day, only the memory of that school remains. Turning to the north one beholds the great expanse of the Bay of Naples, and by the aid of a glass discovers the aquarium, the institution which to-day has fallen heir to all that was best in the traditions of the Salerno school. The latter was a slow growth, the result of the labors of many men upbuilding painfully for many years while the Naples Aquarium was the creation of one man—Anton Dohrn, whose life was devoted to devising and perfecting unequaled facilities for the study of zoology; and he builded better than he knew, for he actually, although unconsciously, created a university. Year after year a greater number of trained investigators, representing practically all the civilized governments of the world, are gathered together at the aquarium than are to be found in any other institution in the world. Within this building, racial prejudices and differences are ignored or forgotten by the brotherhood of scholars who carry on their work for the benefit of their common humanity.

The scientific work of Dohrn has received generous commendation from his fellow workers in the sciences, but it still remains for those who labor to preserve the peace of the world to show their appreciation of the quiet, unostentatious but potent influence upon the thought of mankind of "the peace congress" which is continuously in session at the Naples Aquarium.

STEWART PATON
PRINCETON, N. J.

THE PALEONTOLOGICAL SOCIETY

AT the first meeting of the society at 10 A.M., on December 29, in the University Museum, Cambridge, there will be a Conference on the Aspects of Paleontology, the program of which is as follows:

Adequacy of the Paleontologic Record: Samuel Calvin, R. S. Bassler.

Interdependence of Stratigraphy and Paleontology: W. J. Sinclair, E. O. Ulrich.
Biologic Principles of Paleogeography: Charles Schuchert, F. H. Knowlton.
Paleontologic Evidences of Climate: T. W. Stanton, David White.
Migration: Henry S. Williams, Arthur Hollick.
Paleontologic Evidences of Adaptive Radiation: H. Fairfield Osborn.
Anatomy and Physiology in Extinct Organisms: Charles R. Eastman, Rudolf Ruedemann.
Contributions to Morphology from Paleontology: Wm. Bullock Clark, Charles D. Walcott.
Embryology and Paleontology: Richard S. Lull, William H. Dall.
Ontogeny and Paleontology: F. B. Loomis, Amadeus W. Grabau.
Phylogeny and Paleontology: Robert T. Jackson, D. P. Penhallow.
Paleontologic Evidences of Recapitulation: E. R. Cumings, L. Hussakof.
Isolation in Paleontology: John M. Clarke.
Continuity of Development from the Paleontologic Standpoint: W. D. Matthew, T. Wayland Vaughan.
Paleontology of Man: S. W. Williston, John C. Merriam.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SECTION B, PHYSICS AND THE AMERICAN PHYSICAL SOCIETY

At the Boston meeting of the American Association for the Advancement of Science, Section B and the American Physical Society, will in general hold joint sessions for reading papers. The presiding officers will be Dr. L. A. Bauer, of Washington, chairman of Section B, and Professor Henry Crew, of Northwestern University, president of the Physical Society. The address of the retiring vice-president of Section B will be given by Professor Karl E. Guthe, of the University of Michigan. Section B will hold one joint session with Section A, at which several distinguished scientists have promised papers which will be of interest to other sections. Another session will be given to the discussion of the teaching of physics, perhaps in conjunction with Section L.

The program of special papers on research topics will be in charge of the secretary of the Physical Society and titles should be sent to him at Ithaca, N. Y. All titles should be in his hands by December 14, accompanied by a suitable abstract.

Ernest Merritt,
Sec. Am. Physical Soc.
Alfred D. Cole,
Sec. of Section B, A. A. A. S.

SECTION A, MATHEMATICS AND ASTRONOMY

Arrangements have been made for two joint sessions of Section A. The first of these is to be held jointly with Section B on Tuesday afternoon, December 28, and the second is to be a joint session with the American Mathematical Society on Wednesday morning. The vice-presidential address of Section B is to be given during the former of these sessions and that of Section A during the latter. The section will organize on Monday morning, and the sessions of Monday afternoon and Tuesday morning will be devoted almost exclusively to astronomical papers. Titles and abstracts should reach the secretary before December 15.

G. A. Miller,
Secretary of Section A

SECTION F, ZOOLOGY

Owing to a clerical error, the preliminary announcement of the Boston meeting wrongly states that a joint session will probably be arranged between Section F and the American Society of Zoologists. The officers of Section F proposed a plan for referring to the American Society of Zoologists the reading of all worthy zoological papers by authors who are not members of that society; but it was rejected by a vote "to keep the meetings of the American Society of Zoologists entirely independent." As a result, it is planned by the officers of Section F to hold on Friday, December 31, a meeting for reading of papers by members of that section who do not on their personal responsibility arrange for presenting their papers in the meetings of the American Society of Zoologists or elsewhere. On the days when that society is reading technical papers, Section F will offer a series of programs designed to appeal to the intelligent public and to men of science who are not primarily zoologists. Thus the conflicting

meetings which so much disturbed the equanimity of zoologists at Baltimore last year will be entirely avoided.

M. A. BIGELOW,
Secretary of Section F

THE CONVOCATION WEEK MEETINGS OF SCIENTIFIC SOCIETIES

THE American Association for the Advancement of Science and the national scientific societies named below will meet at Boston, Mass., during convocation week, beginning on December 27, 1909.

American Association for the Advancement of Science.—Retiring president, Professor T. C. Chamberlin, University of Chicago; president, Dr. David Starr Jordan, of Stanford University; permanent secretary, Dr. L. O. Howard, Cosmos Club, Washington, D. C.; general secretary, Professor Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

Local Executive Committee.—H. W. Tyler, chairman; Thomas Barbour, J. S. Kingsley, Edward R. Warren, John Warren, George W. Swett, secretary.

Section A, Mathematics and Astronomy.—Vice-president, Professor Ernest W. Brown, Yale University; secretary, Professor G. A. Miller, University of Illinois, Urbana, Illinois.

Section B, Physics.—Vice-president, Dr. Louis A. Bauer, Carnegie Institution, Washington, D. C.; secretary, Professor A. D. Cole, Vassar College, Poughkeepsie, N. Y.

Section C, Chemistry.—Vice-president, Professor William McPherson, Ohio State University; secretary, C. H. Herty, University of North Carolina, Chapel Hill, N. C.

Section D, Mechanical Science and Engineering.—Vice-president, Professor John F. Hayford, Northwestern University; secretary, G. W. Bissell, Michigan Agricultural College, East Lansing, Mich.

Section E, Geology and Geography.—Vice-president, Reginald W. Brook, Canadian Geological Survey; secretary, F. P. Gulliver, Norwich, Conn.

Section F, Zoology.—Vice-president, Professor William E. Ritter, La Jolla, Cal.; secretary, Professor Morris A. Bigelow, Columbia University, New York City.

Section G, Botany.—Vice-president, Professor David Penhallow, McGill University; secretary, Professor H. C. Cowles, University of Chicago, Chicago, Ill.

Section H, Anthropology.—Vice-president, Dr. W. H. Holmes, Bureau of American Ethnology; secretary, Dr. George Grant MacCurdy, Yale University, New Haven, Conn.

Section I, Social and Economic Science.—Vice-president, Byron W. Holt, 54 Broad St., New York City; secretary, Dr. John Franklin Crowell, 44 Broad St., New York City.

Section K, Physiology and Experimental Medicine.—Vice-president, Professor C. S. Minot, Harvard Medical School; secretary, Dr. Wm. J. Gies, College of Physicians and Surgeons, Columbia University, New York City.

Section L, Education.—Vice-president, Dean James E. Russell, Columbia University; secretary, Professor C. R. Mann, University of Chicago, Chicago, Ill.

The American Society of Naturalists.—December 29. President, Professor T. H. Morgan, Columbia University; secretary, Dr. H. McE. Knower, University of Toronto, Toronto, Can. *Central Branch.* President, Professor R. A. Harper, University of Wisconsin; secretary, Professor Thomas G. Lee, University of Minnesota, Minneapolis, Minn.

The American Mathematical Society.—December 28–30. President, Professor Maxime Bôcher, Harvard University; secretary, Professor F. N. Cole, 501 West 116th St., New York City.

American Federation of Teachers of the Mathematical and Natural Sciences.—December 27, 28. President, Professor H. W. Tyler, Massachusetts Institute of Technology; secretary, Professor C. R. Mann, University of Chicago, Chicago, Ill.

The American Physical Society.—President, Professor Henry Crew, Northwestern University; secretary, Professor Ernest Merritt, Cornell University, Ithaca, N. Y.

The American Chemical Society.—December 27–31. President, Dr. Willis R. Whitney, General Electric Company, Schenectady, N. Y.; secretary, Professor Charles L. Parsons, New Hampshire College, Durham, N. H.

The Geological Society of America.—December 29, 31. President, Dr. G. K. Gilbert, U. S. Geological Survey; secretary, Dr. E. O. Hovey, American Museum of Natural History, New York City.

The Association of American Geographers.—December 30–January 1. President, Professor W. M. Davis, Harvard University; secretary, Professor Albert P. Brigham, Colgate University, Hamilton, N. Y.

The American Society of Vertebrate Paleontologists.—December 27–29. President, Dr. J. C.

Merriam, University of California; secretary, Dr. E. S. Riggs, Field Museum of Natural History, Chicago, Ill.

The American Society of Biological Chemists.—December 28–30. President, Professor Otto Folin, Harvard Medical School; secretary, Professor William J. Gies, 437 West 59th St., New York City.

The American Physiological Society.—December 28–30. President, Professor W. H. Howell, Johns Hopkins University; secretary, Dr. Reid Hunt, Hygienic Laboratory, 25th and E Sts., N. W., Washington, D. C.

The Association of American Anatomists.—December 28–30. President, Professor J. Playfair McMurrich, University of Toronto; secretary, Professor G. Carl Huber, 1330 Hill St., Ann Arbor, Mich.

The Society of American Bacteriologists.—December 28–30. President, Dr. J. J. Kinyoun, Washington, D. C.; secretary, Dr. Norman MacL. Harris, University of Chicago, Chicago, Ill.

The American Society of Zoologists.—Eastern Branch, December 28–30. President, Professor Herbert S. Jennings, Johns Hopkins University; secretary, Dr. Lorande Loss Woodruff, Yale University, New Haven, Conn.

The Entomological Society of America.—December 29, 30. Secretary, J. Chester Bradley, Cornell University, Ithaca, N. Y.

The Association of Economic Entomologists.—December 28, 29. President, Professor W. E. Britton, Connecticut Agricultural College; secretary, A. F. Burgess, U. S. Department of Agriculture, Washington, D. C.

The Botanical Society of America.—December 28–31. President, Professor Roland Thaxter, Harvard University; secretary, Professor D. S. Johnson, Johns Hopkins University, Baltimore, Md.

American Nature Study Society.—January 1. President, Professor C. F. Hodge, Clark University; secretary, Professor M. A. Bigelow, Teachers College, Columbia University, New York City.

Sullivant Moss Society.—December 30. President, Professor Bruce Fink, Miami University, Oxford, O.; secretary, Mrs. Annie Morrill Smith, 78 Orange St., Brooklyn, N. Y.

Wild Flower Preservation Society.—President, Professor Chas. E. Bessey; secretary, Dr. Charles Louis Pollard, New Brighton, N. Y.

The American Psychological Association.—December 29–31. President, Professor Charles H. Judd, University of Chicago; secretary, Professor A. H. Pierce, Smith College, Northampton, Mass.

The American Anthropological Association.—December 27–January 1. President, Dr. W. H. Holmes, Bureau of Ethnology; secretary, Dr. Geo. Grant MacCurdy, Yale University, New Haven, Conn.

The American Folk-lore Society.—Week of December 30. President, Dr. John R. Swanton, Bureau of American Ethnology; acting secretary, Dr. R. B. Dixon, Peabody Museum, Cambridge, Mass.

Association of Mathematical Teachers in New England.—December 28. President, Charles A. Hobbs, Watertown, Mass.; secretary, George W. Evans, Charlestown High School, Boston, Mass.

Physics Teachers of Washington, D. C.—Meets in conjunction with American Federation of Teachers. President, W. A. Hedrick, McKinley High School, Washington, D. C.; secretary, Dr. Howard L. Hodgkins, George Washington University, Washington, D. C.

American Phytopathological Society.—December 28–30. President, Dr. L. R. Jones, University of Vermont; secretary, Dr. C. L. Shear, U. S. Department of Agriculture, Washington, D. C.

American Alpine Club.—December 30. Secretary, Dr. Henry G. Bryant, Room 806 Land Title Building, Philadelphia, Pa.

American Breeders' Association.—Meeting of Eugenics Committee. Secretary, Dr. Chas. B. Davenport, Cold Spring Harbor, N. Y.

SCIENTIFIC NOTES AND NEWS

The Philosophical Society of Washington held on December 4 a meeting commemorative of the life and services of Professor Simon Newcomb, late president of the society. The program included addresses by the Honorable James Bryce, Dr. Milton Updegraff, Dr. R. S. Woodward, Dr. L. O. Howard and Dr. E. M. Gallaudet.

Professor Edward C. Pickering, director of the Harvard College Observatory, has been elected a vice-president of the American Philosophical Society, to fill the unexpired term of the late Professor Simon Newcomb.

Mr. John Fitz, of Bethlehem, Pa., has been elected an honorary vice-president of the Iron and Steel Institute of Great Britain, under the new by-laws, which permit the election of distinguished foreign members as honorary vice-presidents.

DR. CLEMENS VON PIRQUET, Johns Hopkins University, has been awarded the Goldberger Prize of 2,000 crowns by the Imperial and Royal Society of Physicians of Vienna on account of his discoveries of certain phases of immunity and skin reaction in the diagnosis of infantile tuberculous lesions.

PROFESSOR W. BATESON, F.R.S., has resigned the chair of biology in the University of Cambridge to accept the directorship of the John Innes Horticultural Institution at Merton, Surrey.

DR. R. O. E. DAVIS, formerly associate professor of general chemistry in the University of North Carolina, is now soil physicist in the U. S. Bureau of Soils.

DR. F. R. WHITE, assistant to Mr. David Barrows, director of education in the Philippine Islands, has been appointed to this position as successor to Mr. Barrows.

PROFESSOR M. J. M. HILL, F.R.S., vice-chancellor of the University of London and professor of mathematics, has been elected an honorary fellow of Peterhouse, Cambridge, of which he was formerly a fellow.

MISS E. M. BRESEE, of Madison, who graduated from the University of Wisconsin in 1908 after specializing in chemistry, has been appointed assistant chemist in the department of feed and fertilizer inspection in the College of Agriculture, to succeed Mr. W. A. Brannon, who resigned to accept appointment as assistant chemist to the State Dairy and Food Commission.

CAPTAIN SCOTT, the head of the proposed British Antarctic expedition, has received a letter from Major Darwin, president of the Royal Geographical Society, stating that the council of the society heartily approves of the expedition and will contribute £500 towards the sum needed. The president and council of the Royal Society have also intimated that they will be happy to subscribe £250 from their private funds towards the scientific objects of the expedition.

THE Livingstone gold medal of the Royal Scottish Geographical Society has been presented to Sir Ernest Shackleton, in recognition of his work in the Antarctic.

WE learn from *Nature* that the Royal Society of Edinburgh has presented the Makdougall-Brisbane prize for the biennial period 1906–8 to Mr. D. T. Gwynne-Vaughan for his papers (1) "On the Fossil Osmundaceæ," and (2) "On the Origin of the Adaxially Curved Leaf-trace in the Filicales"; and the Gunning Victoria Jubilee prize for the third quadrennial period 1904–8 to Professor G. Chrystal, for "A Series of Papers on 'Seiches,' including 'The Hydrodynamical Theory and Experimental Investigations of the Seiche Phenomena of Certain Scottish Lakes.'"

LIEUT.-COLONEL D. PRAIN, F.R.S., director of the Kew Botanic Gardens, and Dr. F. O. Bower, F.R.S., professor of botany at Glasgow, have been elected corresponding members of the Munich Academy of Sciences.

MR. A. D. E. ELMER is about to return to Manila with a large collection of plants that he has made in the southern part of Mindanao, from Davao as a base. The botany of this region is entirely unexplored, and something of its richness is indicated by the fact that only two species of oak have been reported from that region while Mr. Elmer finds at least fourteen.

PROFESSOR C. J. BOURNE delivered the Herbert Spencer lecture at Oxford on December 2. The subject was "Herbert Spencer and Animal Evolution."

BY the death of Mr. John Masterson, of New York, at the age of ninety-seven years, a gift takes effect of $4,000,000 which was made in 1902 to provide for poor persons during convalescence.

THE public library and museum at Kilmarnock, Scotland, was destroyed by fire on November 26. The building, known as the Dick Institute, was presented to the town by the late Mr. James Dick, of Glasgow, about nine years ago. The museum contained the geological collection of the late Mr. James Thomson, and a considerable portion of the Braidwood collection of curios which belonged to the late Dr. Hunter Selkirk, of Braidwood. These were completely destroyed. The damage will probably amount to about £50,000.

The Chemists' Club of New York has inaugurated a plan for bringing together the professors of chemistry of the various universities with their former students at the smokers of the club. Saturday evening, November 27, was designated as Harvard Night, to which the professors of that university and the members of the New York Harvard Club were invited as guests. Professors Richards, Torrey and Baxter outlined the lines of investigation being conducted in their respective departments. It is hoped that in future meetings the chemists of New York will have opportunities for coming into contact with the work of the various other colleges in a similar fashion. The finance committee was able to announce subscriptions amounting to upwards of $200,000 to the Chemists' Building Company.

The ninth annual meeting of the American Philosophical Association will be held at Yale University, New Haven, Conn., on December 27, 28 and 29. The subject selected for discussion is: The problem of time in its relation to present tendencies in philosophy. Stop-over at New Haven will be allowed to persons holding tickets reading *via* that point to Boston to attend the meeting of the American Association for the Advancement of Science and the American Psychological Association. Tickets must be deposited at station office at New Haven not later than December 29, and must be withdrawn from deposit in time to reach Boston not later than December 30.

The Sullivant Moss Society will meet in affiliation with the American Association for the Advancement of Science at Boston on Thursday, December 30, at 2.30 P.M. in the hall of the Boston Natural History Society, Berkeley Street. An informal meeting will be held during the morning hours to view exhibits and make acquaintance. The program meeting in the afternoon is open to all and will be followed by a general discussion. For further particulars address Mrs. Annie Morrill Smith, 78 Orange Street, Brooklyn, New York, in whose care all manuscripts, etc., should be sent. Titles and abstracts of papers should be sent in at once to secure place on the program.

The *Standard* for November 22, says *Nature,* contains a full list of the House of Lords, classified according to their qualifications. There are only two names—those of Baron Rayleigh and Baron Lister—under the heading "Scientists," while "Educationists" are only represented by Baron Ashcombe, member of council of Selwyn College; Baron Killanin, member of senate of Royal University of Ireland, and the Earl of Stamford, formerly professor of classics and philosophy at Codrington College, Barbados. There are thirty-five railway directors, thirty-five bankers and thirty-nine so-called "captains of industry" on the list, and a column and a half under "Military and Naval Services."

UNIVERSITY AND EDUCATIONAL NEWS

The Duke family have made a further gift of $500,000 to Trinity College, Durham, N. C., for the establishment of a medical department.

Mrs. Helen Hartley Jenkins has given a considerable sum to endow a fund at Teachers College, Columbia University, providing for a department to instruct trained nurses, who are expected to give instruction on the care of the sick, sanitation, etc.

According to figures available in the office of the auditor, the University of Chicago holds investments representing permanent endowment that aggregate $14,870,903.01. In addition, its buildings and grounds devoted entirely to university use represent $8,917,-708.10; equipment, scientific apparatus, furniture, etc., being put at $1,916,314.49 additional. These figures do not include the funds destined for the erection of the Harper Memorial Library, estimated in round figures to cost $900,-000, on which work will probably begin next year, nor the cost of the classical building, the construction of which is in contemplation, and on which about $250,000 will be expended.

The University of Brussels has received gifts amounting to $1,300,000.

Emeritus Professor Thomas Purdie has offered to the University of St. Andrews the

sum of £2,000 to provide the salary of an assistant in the Purdie Chemical Research Laboratory.

THE Special Board for Moral Science of Cambridge University calls the attention of the senate in a report to the need of more adequate accommodation for the laboratory of experimental psychology. At Oxford an excellent laboratory devoted to experimental psychology has recently been erected. It is estimated that a building adequate for the present needs of the department might be erected at a cost of £3,000, and to this must be added £1,000 for fittings. Towards this amount nearly £3,700 has been already promised or paid, but this includes an offer of £3,000 made on condition that the building is begun without delay.

AT Cornell University, the graduate department, hitherto under the jurisdiction of the university faculty, has been reorganized as a separate college under the title of the Graduate School. A research professorship has been conferred upon Professor Titchener, who becomes Sage professor of psychology in the Graduate School.

Among recent appointments at the Iowa State College are the following: W. W. Dimock, B.Agr., D.V.M. (Cornell), associate professor of veterinary medicine; W. M. Barr, B.S. (Iowa, '02), Ph.D. (Pennsylvania, '08), associate professor of metallurgy; Archibald Leitch, B.S.A. (Ont. Agr. Col., '05), assistant professor of animal husbandry; W. H. Pew, B.S.A. (Iowa State, '07), assistant professor of animal husbandry; Ira G. McBeth, B.S.A. (Ohio, '07), M.A. ('08), assistant professor of soil bacteriology; H. W. Gray, B.C.E. (Iowa State, '06), assistant professor of civil engineering; H. E. Ewing, A.B. (Illinois, '06), M.A. ('08), assistant professor of zoology.

DR. OSCAR KLOTZ, assistant in pathology at McGill University, Montreal, has been appointed professor of pathology in the University of Pittsburgh.

HAMDEN HILL, A.B., has been appointed instructor in chemistry in the University of North Carolina.

DISCUSSION AND CORRESPONDENCE

INTERNATIONAL LANGUAGE

TO THE EDITOR OF SCIENCE: In order that American scientists may know something more of "Ido" than is given in Professor Jespersen's article in SCIENCE of November 12, I quote below a statement of Professor Dr. Förster, who was a member of the International Language Committee referred to by Professor Jespersen, and honorary president of it. This statement is taken from *Germana Esperantisto*, for December, 1908, pp. 138–9. Professor Förster, who was formerly director of the Berlin Observatory, says:

> I was a member of the international committee whose duty it was to examine critically the most important hitherto existing systems of international language. The past autumn [*i. e.*, in 1907] this committee recognized Esperanto as the most satisfactory hitherto existing auxiliary language. At the same time, the committee, without an intention of disturbing the essential genius of the language, recommended some reforms, by means of which it was thought to attain a more rapid and general spread of Esperanto.
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> But the committee, or rather the commission elected by it, failed to secure the absolutely necessary consent of the officials of the already extensive Esperanto organization to their reforms, which the whole body of Esperantists, with very few exceptions, did not consider as improvements.
>
> But instead of consenting that the effort be made to introduce the reforms gradually, in consideration of the natural resistance of such an enthusiastic movement, the commission, going beyond the task given it by the committee, and against the desire of eminent members of the committee, assumed towards the officials of the Esperanto movement a critical air of superiority and attempted themselves to spread a reformed, and even in its external aspect essentially changed language, which they variously called "Ido," "Ilo," "Reform-Esperanto," "Esperanto-simplified," etc., although the Esperantists did not consent to the use of the name Esperanto and although the additions "reform" and "simplified" contradicted the conviction of nearly all Esperantists.
>
> This procedure caused me not only to relinquish the honorary presidency, but also to resign from the committee, for in such proceedings there is lacking, in my opinion, any degree of social wis-

dom, and I find them suitable only for creating confusion, and of putting in danger the progress attained after decades of hard work.

Professor Förster was not the only member of the committee who resigned from it in disgust at the action of the subcommittee. In the *Germana Esperantisto,* No. 8, 1909, Professor Dr. Ad. Schmidt, one of those members who left the committee, speaks very pointedly of the misrepresentations in an article published by Dr. Pfaundler, one of the men whose names were mentioned by Professor Jespersen. Couterat, also mentioned by Jespersen, is editor of the official organ of the "Idists." In a recent number of this journal he prints statements concerning the position gained by Esperanto at the Psychological Congress last summer that, to say the least, are misleading, though in a subsequent number he publishes a very lame retraction.

Since the disruption of the International Language Committee, occasioned by the belief on the part of conservative members that the subcommittee were putting in jeopardy the whole question of an international language, a faction of that committee have continued the propaganda for Ido, a language invented, according to Dr. Schmidt, by the Marquis de Beaufront, one of the most ardent of Esperantists, and a most powerful opponent of changes in Esperanto. Beaufront himself had abandoned his own language because he considered Esperanto superior to it, and, on account of his staunch advocacy of the latter, had been commissioned as the personal representative of Dr. Zamenhof before the language committee. In addition to the faction referred to there are scattered here and there in Europe and America a few opponents of Esperanto who call themselves Idists, Ildists, etc. These gentlemen are not at all agreed as to the structure of their language. Their official organ is devoted, not so much to the propagation of a particular form of international language, as to a learned (?) discussion of what the characteristics of an international language should be, and to an attempt to discredit Esperanto. It is not uncommon for the contributors to this magazine to give, in connection with their articles, a synopsis of the grammatical forms with which at the time they are experimenting. Even the Idists are now beginning to perceive the folly of their course, and are beginning to clamor for a "period of stability," the one thing they have fought most strenuously in Esperanto, and the absolutely essential element of success. Esperantists realize that to open the gate to "improvements" can only end in a wrangle that means certain death to the movement for an international language, which at present has such brilliant prospects.

The writer well remembers when he began the study of German, how many things he found in it that he could have improved. The same was true of French. It is not strange, therefore, that beginners should have a strong desire to "improve" Esperanto. But after two and a half years study of Esperanto, the writer has come very fully to the conviction that the very points in which he desired to see the language changed are the best features of it. After having acquired the ability to read Esperanto practically as freely as English, and the ability to speak it with a fair degree of freedom, the writer is of opinion that, without any changes whatever, Esperanto will make a satisfactory international language. Professor Jespersen refutes his own statement that Esperanto can not be printed in any printing office, by showing in the latter part of his article that this can be done. Since more consonant sounds are needed than there are letters, Dr. Zamenhof chose two ways of representing certain sounds, one with supersigned letters, the other with combinations of letters. Either may be used. Telegrams are sent daily in Esperanto, Professor Jespersen's statement to the contrary notwithstanding. His statement (in Esperanto) that this language lacks many roots is trivial. If he knows Esperanto he knows that in the laws governing the development of the language *any root whatever* can be added by *any Esperantist* whenever needed, the only requirement being that the root shall be adequately defined. If, then, the new root is taken up by writers of repute, it is in due time given formal approval by a committee having full authority. Eight hundred and

seventy new roots were thus approved last year. Others will be added as needed.

In Washington city, during the past week, we have had the opportunity of hearing Esperanto spoken by Professor Arnold Christen, an adept in the language. I have yet to find any one who has heard him speak in Esperanto who does not say with enthusiasm that it is the most beautiful spoken language he has ever heard. Next summer the international scientific association will meet in Washington, and all its deliberations will be conducted in Esperanto. Any one who doubts the sufficiency of the language would do well to attend the meetings of this association.

W. J. SPILLMAN

THE ADVANCE OF INTERNATIONAL LANGUAGE

I HAVE read with interest Professor Jespersen's article on "International Language" in SCIENCE for November 13. Professor Jespersen's name and his rank as exchange professor at Columbia University, together with his report on the decision of the International Scientific Committee, may, among many who have not investigated the subject, win credence to the possibility of the advance of the cause of international speech resulting from adopting Ido in place of the more familiar Esperanto.

Inasmuch as I am one of those who helped to elect the International Scientific Committee, which, as Professor Jespersen mentions, announced that Esperanto "might serve as a basis for the international language provided it were thoroughly modified and improved on certain specifically indicated points," I feel that I must decline any responsibility for the actions of that body. I especially deprecate the committee's arrogating to itself the authority to construct and advance a new language system. Aside, however, from the question of the origin of Ido, as scientists should generally be sufficiently broad-minded to accept a thoroughly good thing, no matter what its origin, I wish to call attention to some facts of which we should take note in considering the question of an international language.

Esperanto is not a hypothetical system for international communication, but is a language in actual use, possessing not merely grammars, readers and dictionaries, but a wealth of literature both general and technical in character. It has propaganda journals published in almost every civilized country on the globe, and also a large number of magazines devoted to special subjects, such as medicine, literature, photography, etc.—over ninety periodicals in all. At the present time the most important journal to the scientist is the *Internacia Scienca Revuo* published at Geneva, Switzerland, under the patronage of Dr. Zamenhof, the French Astronomical Society, the French Physical Society and the International Society of Electricity, and the fifth volume, completed in 1908, bears the names of such men as Adelskold, Appell, D'Arsonval, Baudoin De Courtenay, Becquerel, Berthelot, Prince Roland Bonaparte, Bouchard, Deslandres, Flournot, Förster, Haller, William James, Mourlon, Henri Poincaré, General Sebert and J. J. Thompson. It is worthy of note also that technical Esperanto vocabularies for each science are being compiled by specialists from many nations.

In Europe there are Esperanto hotels and Esperanto consulates, and in both Europe and America and even in far-away Japan there are Esperantists in every city of large size and in innumerable small towns. Many business firms in London and Paris as well as in this country are known to the writer as using Esperanto for correspondence and advertising, and it is to be presumed that these represent a very small proportion of the commercial firms having found it advantageous to use this language. It might be added that linotype machines can be equipped with the additional characters for writing Esperanto at a cost of $1.50, and a typewriter can be equipped with the extra characters for less than $1.00; in fact, some of the standard typewriters are made with Esperanto characters without extra charge. Surely it should be as easy also to telegraph in Esperanto with its six supersigned letters as it is to telegraph in French with its acute and

grave and circumflex accents, or in German with its umlauts; but to deal in facts and not in theories, during the past month I have had personal knowledge of important telegrams and cablegrams that had been transmitted in this international language.

International congresses on various subjects are using Esperanto, for statistics on which highly important point I need only refer to page 478 of SCIENCE for October 8; and the Esperantists themselves have tested this language in five successive international Esperanto congresses and have given overwhelming proof of its practicability. The Fifth Esperanto Congress, held last September in Barcelona, Spain, was attended by 1,300 delegates in spite of the unrest prevalent in that city. The sixth congress will occur in the United States next August and will bring proof to our very door, if it be that we still need proof, that the language is musical, remarkably easy, and a success, and after all the main point for an international language is that it should be a success.

Ido, Ildo, Purified Esperanto, Esperantido and Esperido, as it has been variously called, on the other hand, as far as statistics have been obtainable, has less than thirty adherents in the United States, in which list for the present I include Professor Jespersen. The following of Ido in European countries I understand to be proportionately small. It has a few readers and grammars and textbooks and much diatribe against Esperanto, but no literature whatever. It has ten periodicals, including both propaganda and other magazines, a number of which, while attacking Esperanto, have been printed partly in Esperanto in order to reach the public. In this list of ten I am including one little sheet published in the United States and designated a quarterly, though its first and latest issue appeared in April of this year. Ido has had no congresses or similar assemblies before which this proposed system for international communication could be tested. But in addition to returning the Scotch verdict of not proven to the Idists' claims for recognition, I wish to advance certain reasons why I believe Esperanto to be superior in construction to Ido, Ildo, Esperido, etc.

1. Esperanto is more musical, for in cutting out the six supersigned letters Ido and its related systems have been forced to reduce the sounds also; thus a so-called "purification" has resulted in monotony.

2. Esperanto has definite rules and no exceptions, it is in short a logical language, while there are many exceptions recognized as proper to the rules of Ido or Purified or Simplified Esperanto.

3. Esperanto is the most truly international language in several important details, and therefore may be most easily learned by all civilized races, while Ido, or Simplified Esperanto, with its harsh Anglo-Saxon pronunciation of the letter *j*, and its fixed Franco-English word order would prove troublesome to most Europeans.

KARL F. KELLERMAN
BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

COLLEGE SOLIDARITY

WHEN ideas that have been in the air are, as it were, precipitated by the utterance of an eminent man in an authoritative position, they suddenly become fructifying and productive of both wheat and tares. If, therefore, solutions both profitable and unprofitable to the college problem were numerous before President Lowell's installation address, they may be expected in increasing numbers to follow his clear and impressive presentation of the needs of American colleges. And indeed, the greatest direct benefit to be expected from this conspicuous discourse must be the incitement it will prove to all intimately interested in our colleges to formulate and publish their convictions as to the best means of meeting needs widely recognized and admitted.

There can be little question that President Lowell is right in his opinion that the passing of the common habitation made necessary by the increased number of students, and the passing of the common curriculum attending the introduction of the elective system, have resulted in social and intellectual disintegration. Further, it will be granted that the old

complete college "solidarity" belongs to the old order and that we shall now have to be content with the intellectual and social cohesion of groups of students. The effectiveness of the method he has suggested for reaching this end is, moreover, reasonably sure. That the segregation of the freshman in class dormitories and dining halls would result in an intensification of class spirit is patent. A class thus centralized and made aware of itself during its first year, would inevitably gain something of social unity and identity. But would the gain be worth the cost to the college and to the individual?

In calling attention to the great educative value of intercourse between classmates far called from all the corners of the country or of the world, Cardinal Newman noted, over half a hundred years ago, that this was not due entirely to the students of the university, but was largely dependent upon the *genius loci*. "Independent of direct instruction on the part of superiors," he said in the sixth discourse in "Idea of a University," "there is a sort of self-education in the academic institutions of protestant England; a characteristic tone of thought, a recognized standard of judgment, is found in them, which, as developed in the individual who is submitted to it, becomes a two-fold source of strength to him, both from the distinct stamp it impresses on his mind, and from the bond of union which it creates between him and others." In several of our American colleges such a spirit is already appreciable, and it is a recognition of its value that influences men and women to send their sons and daughters across the continent, if need be, to our long-established colleges when there are colleges at their doors offering similar academic courses under the direction of men of the highest scholarship, when economy and family affection, and all tangible arguments are in favor of the home college. It is for this that sons are dedicated from their birth to Yale or Harvard, and daughters to Vassar or Wellesley, irrespective of transient administrative policy or the individual members of the teaching force. This subtle but precious power is imperiled by the segregation of the freshman class. If successive incoming classes acquire solidity before they have been subject to the atmosphere of the institution, while they are yet unaware of its standards and traditions, they must soon become incapable of transmitting or responding to the cultivating influence of what is now considered the permanent and inherent spirit of the place, but which must be radically changed in the course of a few college generations whose classes crystallized in the freshman year. To make more effective the influence of this fine, esoteric force in the college world is the real object of gaining solidarity, and if it be lost our solidarity will be to little purpose.

Nor is this the only objection to the segregation of the freshmen. Inexcusable as the practise of hazing seems, it is not with its purpose that we quarrel. No one can have had much to do with young people in America without appreciating the fact that for the sake of the community and for their own sake, many of our youthful collegians should be taught humility of spirit. The isolation of the freshmen would interfere with the accomplishment of this purpose in the most objectionable way. The most natural way to teach freshmen that they are not of so much importance to others as to themselves is to submerge them in a community of older college men. Finding themselves a submerged fourth in a community of men more at home in the college world, they learn to take a subordinate part in the discussions, to listen to the opinions of others, sometimes to accept them, and even to entertain an opinion without expressing it. The self-centered and contentious are snubbed into right-mindedness before they know it. They learn self-control and discrimination. They come into contact with the older men naturally and learn from them. When they are set apart the upper classmen seek them out chiefly to "rush" them for fraternities. The result is that what was a superficial defect of character is driven in, becoming perhaps less manifest but more deeply rooted.

The presence of a few upper classmen or instructors in a freshman dining hall or

dormitory, can not be counted on to offset the evils of segregation. The Edward Bowens and John Henry Newmans, natural leaders of youth, are rare in the educational world, and too often the desire to influence young people and the power to do so are not coexistent. Many of the instructors by whom students desire to be influenced, whose influence they would not resist, wish after class hours are over to live a life apart from undergraduates. Those who, prompted by the missionary spirit or the need of the remuneration offered for this service, accept such positions, are often merely tolerated, and prove a subduing influence, perhaps, but seldom a vitalizing one. Even where intelligence and good will are forthcoming, divergence of interests makes it difficult for an instructor to discuss in a stimulating manner a question brought from the class-room by an interested student. Occupied in his special field, he remembers dimly the political economy, the literature and history, of his college days. Conclusions previously reached may be carefully registered in his brain and these he can pronounce in the dogmatic manner most fatal to discussion; but the facts which led him to his conclusion, and through which the student must be led to it if he is to reach it at all, he has long forgotten. He can not recall the cogent reasoning he employed to convert his classmates to bimetalism when he cast his first vote; he does not remember why he thought Maggie Tulliver nobler than Tom, or on what grounds Jefferson's loyalty to the Colonial Army could be shown to be no violation of his duty as governor of Virginia.

To criticize with confidence an offered solution is a much simpler matter than to offer a solution not open to criticism, but I believe the natural and right way to insure solidarity for large groups of students is through our academic departments rather than through their dormitory life. The only solidarity that is worth working for is one that touches the social life of the students, to be sure, but one that touches it through academic interests—an indigenous, academic solidarity that grows out of the nature of the college and is not independent of it and merely the result of common youth and humanity and propinquity. In the first place, are modifications of the elective system that are responsible for the intellectual disintegration, and so partly for the social, possible?

If we were to take practical measures toward developing the individual student "in his strong and in his weak points," toward training him to know "a little of everything and something well," we should probably impose some restrictions on the election of courses. We should require, perhaps, the selection of a major subject to be studied through the four college years; we should require in addition the election of such subjects as would insure breadth and diversity of knowledge or train the various faculties of the student. A course in English might be required of all freshmen, a science of all sophomores, an introductory course in philosophy of all juniors. Many of our colleges have, in fact, already established just such requirements. This is one step toward the desired end, in that it provides for all members of the class, year after year, a common academic interest and background of knowledge, and constantly brings together large groups of members of that class for lectures and examinations.

Such an arrangement has in it, moreover, opportunities, as yet, so far as I know, unexploited, for what I may call departmental consolidation. Presupposing the existence of this regulated elective system, every student in college must be closely identified with some one department. During his four years' work in the department in which he has chosen his "major," he must come to know and to be known by the head of the department. Thus, every student would come in contact with one of the first-rate members of the college faculty, and their intercourse would be along lines of real interest to them both, where each would be at his best. If, further, the student were required to consult the head or dean of this department with reference to the election of other courses, and if this head or dean were the one to whom his grades in other courses were reported and to whom he must account

for all academic failures, if, in short, he *belonged* to the department in which he took his major subject and felt himself under the supervision of one officially and personally important to him, he could scarcely maintain an attitude of irresponsibility toward academic work.

The making the department the unit of organization would serve not only to bring into more vital relationship the student and teaching force; it could also be made a strong agency in the bringing together students of like interests. It would be a simple matter to have students belonging to the same department take their required work in other departments in the same divisions. That is, members of the zoological department would recite together in required freshman English classes, in required sophomore mathematics, and so on. For elective courses such an arrangement would be difficult to manage and undesirable. The major course and the required courses would sufficiently bring together the members of one department, and the elective courses should give an opportunity for them to become acquainted with the members of the other departments of the college.

It would be at the discretion of the dean of each department to do as much as he wished toward bringing about inter-class sociability within his department through receptions and lectures for all its members. But even should he do nothing, the social integrity of the department could be depended on. As has already been shown, the acquaintance of the members of each class with each other would result from the mechanical fact of common class divisions for recitations. Departmental publications, "shop" clubs, and so on, would bring the members of the four classes together. Departmental pride would come into being, and the older men in the department would take a friendly interest in the new recruits. Having common academic interests and common friends, members of one department would gravitate towards common lodgings. Under such circumstances *esprit de corps* would promote good fellowship within departments, and wholesome rivalry between them.

This plan of mobilizing the forces for culture in our colleges through the academic departments is open to the criticism that it will result in early, and so mistaken specialization and make students narrow. It is also open to the objection that it will greatly increase the burden of the head of the department.

Safe-guards are provided against extreme specialization and consequent narrowness in that a diversity of work and contact between the members of the several departments, are provided for. Even slight contact between students of centralized and developed interest would be more fruitful of reciprocal interest in the personality and in the work of those concerned, than is the helter-skelter mingling of students too neutral, because of diffused interests, to be felt.

Escape from mistaken specialization would of course be possible through transfer from one department to another. There would, however, if the departments were what they should be, be comparatively few of such cases. It is true that students are unable to tell at the beginning of the freshman year for what work they are best fitted; but this is also true for many now at the close of the senior year. In fact it yearly becomes more difficult for me to doubt that "predestination," so far as work is concerned is largely a matter of accident. I once put to Edison the question, "Had your interest chanced to be directed along some other line, do you think you would have succeeded so well?" His reply was, "Hard to say—I should have made an eighteen-hour-a-day try at it, anyway." And for most of us it is the "eighteen-hour-a-day try" that counts more than inherent aptitude. The marked success of workmen engaged entirely without selection, brought William Morris to this conclusion in a field in which natural ability is supposed to be most indispensable. With the rank and file of college students, as with the rest of mankind, want of interest is, in general, due to want of understanding. With the vitalization of academic work that the proposed plan seeks to effect, no student

would be allowed to graduate without a good understanding of some subject; and most of us would concede that it is worse for a graduate to be interested in nothing, than it would be for him to be interested in a subject in which he may not have been intended to be concerned.

As for his future, it will be possible for the student with capacity and opportunity for the highest personal development, to choose vocational work along another line, and his enthusiastic devotion to one subject and the sense of power that its mastery has given him will be an incentive to determined work in a new field. On the other hand, the student who lacks either opportunity or desire to change, will come out at a higher point when he has completed his professional course, than he would had he not acquired in his undergraduate years the power to do steady, intense, purposeful work.

For the headship of departments exalted almost to the position of constituent colleges of a university, it would be necessary to find men of liberal education as well as sound scholarship in a single field, men who could give character and vitality to a department, who could make themselves felt through their instructors, who could impart to students an enthusiasm for work so deep-seated as to enable them to withstand the lure of other departments when interest in familiar work was brought into competition with the charm of initial knowledge in fresh fields. To find the right men for the top places would be difficult, but it is not so impossible as to provide dormitories with successful proctors of the elder-brother type. The head professor would work under conditions most favorable. He would have large authority. The student coming to him in the spirit of willing discipleship predisposed to find his chosen leader wise and right, would receive instruction with open mindedness and respond quickly to suggestion. By limiting his teaching to the students belonging to his own department, the professor could know the stimulus of working in an atmosphere of scholarly concentration with men seriously sharing his interests, an atmosphere sure to promote that most elevating of human relationships, the impersonal comradeship of those who have sunk sense of self in a common quest. Even granted added work for the head professor, he might in the end count himself a gainer through his enlarged responsibility. F. M. Perry

QUOTATIONS

SECONDARY EDUCATION IN AGRICULTURE IN THE UNITED STATES[1]

Agriculture, including horticulture and forestry (and it is well to bear in mind that where I use the term agriculture I would use it in the ordinary sense to include the whole subject), should be a regular part of public secondary education; (2) the unity of the educational system should be maintained, but there should be sufficient elasticity of curricula to meet the various needs of the people; (3) the standard curriculum of secondary schools having agricultural courses should conform in a general way to that adopted for the general school system of the state; (4) the standard agricultural courses, whether in the ordinary high schools or in special schools, should not be narrowly vocational, but should aim to fit the pupils for life as progressive, broad-minded and intelligent men and women, as well as good farmers and horticulturists; (5) the standard courses in agricultural secondary schools should be so organized as to form a natural and proper preparation for entrance to agricultural colleges.

The conditions of entrance requirements to colleges are, in my judgment, far from satisfactory. It is not likely that we have reached the ultimate plan for the preparation of the great mass of students who in the future will desire college courses. It seems certain that when the so-called vocational subjects are properly organized and taught in the secon-

[1] From an address by A. C. True, director Office of Experiment Stations, before the Association of American Agricultural Colleges and Experiment Stations at Portland, Ore., August 18, 1909, and adopted by the association as containing a statement of principles which it approves regarding secondary education in agriculture.

dary schools they will be generally recognized as having much pedagogical value. This is especially true of agriculture, which is a subject embracing much of the general human interest. Even under present conditions the agricultural colleges would do well to give credit in their entrance requirements for agricultural subjects properly taught in secondary schools.

The agricultural college should have a definite legal relation to our public school system, and especially to the courses or schools of agriculture of secondary and elementary grades. By this I mean that the state legislatures should take definite action recognizing that agricultural colleges have a definite function to aid in the organization of a proper system of secondary instruction in agriculture, and help the secondary schools in that work.

One difficulty now in the progress of this movement is that in quite a number of states the legislation is such that the agricultural colleges, if they take any part in it, have to "butt in." The whole matter of secondary education is in many states intrusted to the state department of education, as far as the state deals with the matter. I think that ought to be remedied. It may be said that that is only part of a wider thing. I do not believe that we have yet in this country considered definitely enough the proper relation of our universities and colleges to the more elementary education. These higher institutions in many states yet stand too much apart from our general system of education. It is very desirable, it seems to me, that they should be recognized by statute everywhere as an essential part of our system of public education. And while that general movement is proceeding the friends of agricultural education should urge that the agricultural colleges should have a definite part in the organization and maintenance of systems of agricultural education in the public schools.

Agricultural colleges will have to do secondary work to a considerable extent for some time to come. We can not, in my judgment, jump immediately in all our agricultural colleges to a state of things where all the secondary work is excluded. This should, however, be definitely organized as separate and distinct from the college work. The aim should be to have all secondary work relegated to secondary schools, entirely separate from the colleges, when such schools are efficiently organized with reference to instruction in agriculture.

Agriculture should be generally introduced into the ordinary high schools. There should also be a limited number of special agricultural high schools in the different states. These should be so limited in number that they will be organized with reference to large districts. I do not believe it is either necessary or desirable to organize such schools with the county as the unit. Experience so far points to the fact that the county is too small a unit for the proper equipment and maintenance of a thoroughgoing agricultural high school. These special schools have a relatively large agricultural faculty and an adequate equipment, so that students going to them will not only have offered to them a standard course of high school or secondary grade, but will also have opportunity to specialize to a certain extent along different agricultural lines. I believe that such schools are needed, because they will in a way set the pace for secondary education in agriculture, and will help rather than hinder the general introduction of agriculture into the ordinary high schools. Besides serving more general purposes, they will attract a good many of the more mature students, who are not ready or financially able to go to college, but desire to go somewhere to get some definite instruction in agriculture, and who are really too old to feel comfortable in the ordinary high school. These schools will also aid in the preparation of teachers and school officers for the rural schools; so that in a way these special agricultural schools will more fully meet the need which is now being met to a limited extent by the special and short courses in the agricultural colleges.

In speaking of this subject, we must, of course, all the time remember the great extent

which this movement will have when once it is in complete operation. It is a comparatively easy matter now for the colleges to take care of this short-course work and a considerable amount of secondary work, because the number of students so far have been comparatively limited in each state. But as we approach the time when we are to have half a million students in agriculture in secondary schools it is going to be a very different proposition. In the near future the colleges will have all they can do to take care of the students in regular college courses in agriculture. The special agricultural schools will fill a great need by attracting the more mature students who would not go to the ordinary high schools, and the ordinary high schools will have plenty of agricultural students of proper high-school age.

As I said, I believe the standard courses in these special agricultural schools should not be narrowly vocational, but should conform, in a general way, to the general standard for the high-school system in the state, and they should be organized so as to connect them definitely with the general educational system of the state. To do this it will probably be found necessary in the case of schools that have shortened the school year to twenty-four weeks of six days each, instead of thirty-six weeks of five days each, to add another year to the standard course, making it five years instead of four. But it would be desirable that besides the standard courses which would prepare the student for college or for life, as the case might be, such schools should have shorter courses more purely vocational.

SCIENTIFIC BOOKS

Experimentelle Untersuchungen über Atomgewichte. Von Theodore William Richards und seinen Mitarbeitern. Berlin, 1909.

In this fine octavo of 890 pages, Professor Richards has brought together, in German translation, the many papers upon atomic weights which, during the past twenty-two years, have been published by him and his collaborators. These researches are already well known to all chemists who are interested in the accurate determination of these fundamental constants, and the results obtained have received very general acceptance. Their collective publication, however, is highly suggestive, and deserves a careful review.

The first of these researches, that upon the atomic weight of oxygen, was carried on by the late Professor J. P. Cooke, with the cooperation of his then student, Richards. The latter began his independent work with a revision of the atomic weight of copper, which was followed by papers upon barium and strontium. Afterwards, Professor Richards had the assistance of his advanced students, and with their aid the atomic weights of zinc, magnesium, nickel, cobalt, iron, uranium, calcium, cæsium, sodium, chlorine, potassium, nitrogen, sulphur and silver have been redetermined, and apparently with the greatest possible accuracy. There is no reasonable doubt that the work done has been a great advance upon all previous investigations of similar purport; but as Professor Richards would himself admit, it is neither final nor absolute. Our knowledge of physical constants is obtained by what may be called a method of successive approximations; but absolute accuracy is unattainable. The researches now before us represent, in all probability, the closest approximations to the truth as yet reached, but that statement does not imply the impossibility of future improvement. Such improvements are likely to be small, however, and to affect only the minor decimals.

In reviewing the work so far done, one can not help noting the steady advance in experimental technique. The later determinations appear to be of a much higher order than the earlier ones. Indeed, several of the papers in the volume are devoted to improvements in manipulation, or to the exposure of constant errors against which the investigator must be always on his guard. The bottling apparatus in which materials are prepared for weighing, and the nephelometer by which mere traces of precipitates are recognized, represent improvements in apparatus. The purification of

materials is elaborately studied; the errors due to occlusions of gases by metallic oxides, and of water by crystallized salts, are pointed out; and by attention to minutiæ of this kind the accuracy of the determinations has been greatly increased.

In general, with a few exceptions, Professor Richards has confined himself to one group of methods, namely, the analysis, by known processes, of metallic chlorides and bromides. These, in nearly all instances, involve a knowledge of the atomic weight of silver, through which the atomic weights of the other elements are referred to that of the standard, oxygen. That is, ratios are determined, from which, with reference to silver as the experimental standard, the other atomic weights are computed. At first, the secondary standard Ag = 107.93, established by Stas, was accepted; latterly, however, it has been shown by several authorities that Ag = 107.88 is nearer the truth, and that the true value may even be slightly lower. This change produces corresponding changes in the other atomic weights; a condition of affairs which is not altogether satisfactory. In most cases each atomic weight determined by Richards is a function of the atomic weights of silver, chlorine and bromine, and these have been, in effect, three variables. Theoretically they are constants, but the values found for them have varied, and the variations are far reaching in their effects. The great exactness of Richards's work is in the measurement of definite ratios, which, once established, form the basis upon which our knowledge of the atomic weights must stand. As the variations in the reference values diminish, the accuracy of our deductions will increase.

From one point of view it is well that the Harvard chemists should have devoted themselves, not exclusively, but in great part, to one group of methods. Those methods have been perfected, their sources of error have probably been reduced to a minimum, and the measurements made with their aid leave little to be desired. Considered more broadly, however, it is desirable that other, radically different methods should be developed with equal thoroughness. Not until that has been done, not until closely agreeing determinations of atomic weights have been made by several distinct reactions and processes, can we regard these constants as sharply established. Work of this sort, especially with reference to the more fundamental atomic weights, is now going on in several laboratories, among which may be mentioned that of Guye, at Geneva. Within the next ten years our knowledge of the atomic weights is likely to be greatly increased. Meanwhile, the work of Richards and his colleagues must be assigned preeminence.

F. W. CLARKE

Elemente der Exakten Erblichkeitslehre. By W. JOHANNSEN. Deutsch wesentlich erweiterte Ausgabe in fünfundzwanzig Vorlesungen. Jena, G. Fischer. Pp. vi + 515. Gebunden, 10 Marks.

The epoch in evolutionary study opened by deVries's "Mutationstheorie" had been one not only of experimentation, but also, fortunately enough, of thoroughgoing analysis. We had analysis of evolution in sufficient amount, even *ad nauseam,* in the latter part of the last century; but the newer speculations are based on novel, experimentally acquired facts, and the marvel of it is that they bear little resemblance to the conventional and orthodox teachings which we accepted almost without question a decade or two ago. It is to the shame of biological science that it must be acknowledged that it was long contented to accept these speculations as fundamental principles without testing them experimentally. But all that is now happily by and the era of framing hypotheses for the purpose only of testing them is well launched.

Of the old ideas, those grouped about variation have undergone, perhaps, the completest analysis. And they needed it too, for if one thing is clearer than another, it is that Darwin and his followers did not analyze the phenomena of variation satisfactorily. It is almost pathetic to see in his letters and books how he fails to distinguish the fundamental differences between fluctuating non-inherit-

able variations and such characters as serve to distinguish one kind of poultry or mammal from another. To-day we see more clearly that a new character, such as "angora" hair or an extra toe, belongs to a different category of variations from ordinary fluctuations in the length of the hairs on the body of a cat and variations in the thickness of a toe; for a hair will be more or less long according to the nutrition it receives at the base (and this varies at different times), and the toe will be more or less thick, depending on the use to which it has been put. The variations dependent on environment or use are, so far as we know, not inherited, while the new characters clearly are. Thus the primary classification of variations is based on their heritability. This much was pre-deVriesian.

The new viewpoint, introduced by deVries, and extended by Johannsen, affects the interpretation of those slight variations that seem to be independent of environment and are distributed about a mean value in the form of the familiar "frequency polygon." The biometric "school" laid stress on this sort of variation, and held that by selective breeding from the extreme variants through many generations an indefinitely wide departure from a starting point might be effected. This deVries denied, but held that, while such selection might lead to a certain departure from the mode, the degree of such a departure was restricted through a strong regressive tendency. Here Johannsen steps in, analyzing more completely this result of breeding from the extremes of the frequency polygon.

The fundamental principle of Johannsen is that an ordinary frequency polygon is usually made up of measurements of a characteristic belonging to a non-homogeneous mass of individuals; that it is really analyzable into several elementary masses each of which has a "frequency polygon" of its own. In each elementary polygon the variation is strictly due to non-inheritable somatic modifications, selection of extremes of which has no genetic significance. But the selection for breeding of individuals belonging to *different* elementary polygons, lying, say, at the extremes of the complex, may quickly lead to an isolation of these elementary polygons, the constituent individuals of which reproduce their peculiarities as distinct elementary species. Thus Johannsen holds that not only do individuals with qualitatively dissimilar characters belong to distinct elementary species, but often such as are only quantitatively unlike. The complex variation-groups are called by the author *phænotypes,* or false types, the elementary variation groups are *genotypes,* or genetic types.

What is the proof of the existence of these two types? It lies in the author's experiments in breeding "in the pure line." Whenever, in a self-fertilizing species, a character is measured through successive generations it does not show a regression toward the mediocre position of the entire population, but regression occurs only to a near-by mode of the elementary genotype. In such a species regression to mediocrity occurs only when we consider the offspring of parents which, even though similar, belong to distinct genotypes. For, since genotypes overlap, the parents, though quantitatively similar in any organ, may have children that regress in an opposite direction to the modes of their (unlike) genotypes, and thus be quite dissimilar to their parents. In the long run the change from parents to offspring will be in the direction of mediocrity. This is the usual result and it has obscured the facts of genotypes in the midst of, and as constituents of, the phenotypes. Now, although self fertilization is necessary to the *proof* of the existence of genotypes, such types are believed to be universal and necessary to the interpretation of heredity and evolution. So the author in his 500-page book rewrites the science of heredity from the new standpoint.

The book is in the form of twenty-five lectures. The first six are devoted to variability and its statistical analysis; then follow five devoted to selection and regression; three to aberrant and complex frequency polygons; four to correlation; two to types of variation; one to effect of environment; two to hybridization; one to nutrition and one to human

heredity and the theory of the determiner. The field is well covered.

Of the sections dealing with variation and selection it may be said that they contain the sharpest analysis yet made of the biological significance of the variation polygon and of its modification under diverse ancestry and environmental conditions. Considerable space is devoted to the interpretation of skew curves, indicating that, for organisms at least, they are not due to an inequality of the plus and minus selective forces but rather are a necessary consequence of an initial inequality of growth combined with the law of *proportional,* as contrasted with absolute, increments. As to selection, the results of extensive experiments, of which the details are given, indicate that selection can not create genotypic differences. Among abnormal frequencies, bimodal polygons receive fullest attention and several causes are deduced, such as: presence of two races, of two age classes, of two environmental conditions, of dimorphism and of mendelian segregation. In treating of correlation tables the author reaches the conclusion, now generally accepted by modern workers in heredity, that, while useful for many purposes, such tables are useless in the study of heredity in the strict sense.

The general effect of the prolonged argument of the author is to arouse enthusiastic acceptance of the principles he works out, which, indeed, seem in the line of necessary development of modern ideas. Every breeder of experience must have noticed the fact that even trivial, often quantitative, differences may be inherited as unit characters and persistently refuse either to blend or to regress. Such are the genotypes of our author. Nevertheless, the body of heredity data is still so small that we may well hesitate to accept in any other spirit than as a working hypothesis the principles of Johannsen. If it should prove to be possible, in a case where the existence of a biotype-complex can be excluded, to pass by "selection" from one genotype to another, then the value of the hypothesis would be greatly diminished. To this test several scientific breeders are devoting their energies and we shall soon have more data on the matter.

CHAS. B. DAVENPORT

SPECIAL ARTICLES

THE ACTION OF RADIUM SALTS ON RUBIES

IN 1906, Marcellin Berthelot[1] found that crystals of amethyst from Brazil became decolorized when heated to 300°, but that on exposing the decolorized crystals to the action of radium chloride, contained in a sealed glass tube, the original color was regained in the course of a few weeks, owing to the reoxidation of the manganese salt. He suggested that the color of amethyst, and possibly of some other precious stones, may be due to the action of radioactive substances while the stones lie buried in the lithosphere.

The following year Bordas[2] reported that when a blue sapphire is exposed to the action of radium bromide of activity 1,800,000, the color changes to a green, then to bright yellow, and finally to a deep yellow. Under the same conditions, a red sapphire was found to change through violet, blue and green to yellow. Bordas stated that the intensity of the reaction can be varied by altering the distance of the stone from the radioactive salt, or by employing radium bromide of different activity; and concluded that since yellow sapphires are the most common, and blue and yellow ones are frequently met with together, it seems probable that the soil in which these precious stones are found is radioactive, and that the stones are undergoing a very slow change analogous to that he observed. Later[3] Bordas observed that by bringing a tube of radium bromide of very high activity (1,800,000) into direct contact with a corundum, and varying its position every few hours, the coloration can be effected evenly in some days. It was ascertained that colorless corundums can be rendered yellow, and the color of natural topazes and faintly colored rubies intensified in color. Artificial rubies were found to be similarly affected.

[1] *Compt. rend.*, 143, 477.
[2] *Compt. rend.*, 145, 710.
[3] *Compt. rend.*, 145, 800.

About the same time Daniel Berthelot[4] published a statement concerning the changes which specimens of certain minerals, placed by Marcellin Berthelot in November, 1906, in the neighborhood of radiferous barium chloride, had undergone in a years' time. It was found that a colorless quartz from la Gardette and a white, cleavable fluorspar were unchanged; that a violet, amethystine quartz (containing manganese) from Uruguay, which had been previously decolorized by heating, was recolored; and that a violet fluorspar from Weardale (Durham) had behaved similarly.

Later Bordas[5] observed that the coloration of crystallized alumina by exposure to radium bromide is not due to the action of the α-rays, since these were absorbed by the glass envelope containing the bromide; but that the γ-rays are operative in this respect, for colorless corundum becomes distinctly yellow after forty minutes, and topaz colored after several hours' exposure to the action of the Röntgen rays, and these rays are analogous to the γ-rays of radium.

On April 5, 1909, the writer received several crystals of ruby from W. P. Dewey, of Los Angeles, Cal. Two of these specimens were placed in radium chloride of 7,000 activity; one in a tube containing radium chloride of 7,000 activity, in order that the emanation would act upon it; and several in a box containing radium of the same activity. These were then set aside in the dark, and examined recently after six months' exposure. No change in color was observed, and the specimens were entirely unaffected.

Chas. Baskerville
College of the City of New York,
November 12, 1909

Demonstrations of Electrical Oscillations

The production of high-frequency oscillations from arc or spark has become such a simple matter that the use of the experiments described by Professor Huff in Science for November 12 is strongly to be recommended, especially as demonstrations before classes in alternating currents. With extremely simple means one can exhibit to an almost extravagant degree some of the effects of alternating currents which at commercial frequencies either do not appear at all, or only with the aid of more costly apparatus.

In this connection the following notes may be of service:

1. Steadier and more rapid oscillations are attainable with the metallic arc than between carbon electrodes. The iron arc in free air gives good oscillations, especially when capacity and self-inductance are so adjusted that the note is a shrill squeak.

2. Many commercial condensers show well the phenomenon of the "musical capacity," *i. e.*, the production of a musical note synchronous with that in the arc. The arc should be placed at a considerable distance from the condenser.

3. Simon's "speaking arc" is shown with a pair of flaming arc carbons and 220-volt supply, making the arc as long as possible. Connect in parallel with the arc a capacity of from 1 to 5 m.f. and the secondary of a small transformer. The transformer primary is in series with a battery and telephone transmitter capable of carrying an ampere. After a little experimentation the arc can be made to reproduce sounds audible throughout a large room.

4. Should the arc go out accidentally, it may be found that the transformer continues to reproduce the sounds, illustrating the "speaking transformer."

5. Some effects at much higher frequencies can be shown by means of the type of discharge recently described by the author.[1] When a discharge at about one tenth of an ampere is passed between metallic terminals in illuminating gas, or better in a mixture of hydrogen and acetone vapor, oscillations of the order of a million per second are generated without the aid of capacity or self-inductance

[4] *Compt. rend.*, 145, 818.
[5] *Compt. rend.*, 145, 874.

[1] *Am. Jour. Sci.*, September, 1909, p. 239. *Phys. Zeitschr.*, September 15, 1909, p. 623.

in parallel with the arc. Besides the usual experiments, the existence of a large number of harmonics may easily be shown by means of resonance. The current in the neighborhood of the discharge is much greater than that taken from the mains, owing to the conversion of direct-current into alternating-current energy. For these experiments an e.m.f. of at least 400 volts, alternating, or better direct, is necessary.

WALTER G. CADY

MIDDLETOWN, CONN.

SOCIETIES AND ACADEMIES

THE AMERICAN PHILOSOPHICAL SOCIETY

Halley's Comet: C. L. DOOLITTLE.

The return of Halley's comet in 1910 has naturally been looked forward to with great interest by astronomers and others. For the purpose of encouraging investigation of the circumstances of its return, a prize of 1,000 Marks was offered by the *Astronomische Gesellschaft* in 1904. A very complete discussion of the available data was carried out by P. H. Cowell and Andrew C. D. Crommelin, of Greenwich. It has been referred to in various places under the motto, "Isti mirantur stellam." The prize was awarded to this discussion.

As soon as the region where the comet was expected to be found had emerged from the sun's rays in 1908, search was undertaken, photographically, in this country and Europe. This was continued until the sun's rays again interfered, but without result. On resuming the process during August of the present year, impressions were found on several plates, the first to achieve success being Dr. Wolf, of Heidelberg. He first detected the image on a plate taken August 28, but did not venture to announce his discovery until September 11. Two plates were taken at Greenwich on September 9. At first nothing was found on either, but a reexamination afterwards showed faint images of the comet on both. It is barely possible that a reexamination of the plates taken last winter may show faint images of the comet, but nothing has been announced up to the present time. It is now easily visible with the 18-inch telescope of the Flower Observatory. The ephemeris of Messrs. Cowell and Crommelin at the time of discovery required a correction of 25 seconds in right ascension and 4 minutes in declination, which must be considered remarkably satisfactory when we remember that the last observations at their disposal were made nearly seventy-four years ago. The time of perihelian passage, given in this discussion, seems to require the correction of 3.4 days, which makes the date April 20, 1910. Another examination of this point gives for the date April 18.63. The nearest approach to the earth will be May 19, distance about 14,000,000 miles, but it will then be so near the sun that it will probably not be visible. On May 18.14, Greenwich mean time, the earth and the comet will be in heliocentric conjunction. It is not unlikely that, on this date, the earth will pass through the tale of the comet. The date when it will be visible to the naked eye is quite uncertain, but probably it will be bright enough for this purpose some time during February, when it will be seen in the western sky after sunset. Toward the end of March, after passing the sun, it appears in the morning before sunrise, reaching its greatest apparent distance from the sun early in May. Toward the middle of May, it again passes the sun and reappears in the evening sky.

Halley's investigation of this comet forms an epoch in astronomical history, but it must be confessed that considerable courage on his part was required to make the prediction of its return in 1759. Probably if he had been aware of the uncertainty attending the identification, depending on the period alone, he would hardly have ventured to make it. Examination of ancient records indicates a succession of visits, extending back to 240 B.C., with the very considerable range of a little more than five years between the longest and shortest period. With such a range some of these supposed appearances must be regarded as resting on rather slight foundation. A committee appointed by the Astronomical Society has formulated a plan for keeping the comet constantly in view, by interesting a series of observers, so placed in latitude and longitude that the comet shall never be lost sight of. A series of photographs, taken in this way, giving a continuous history of the comet, should go far toward solving a number of problems connected with the physical behavior of these bodies.

THE BIOLOGICAL SOCIETY OF WASHINGTON

THE 461st meeting was held November 13, 1909, with President Palmer in the chair. The following communications were presented:

The History of the Mule-footed Hog: W. J. SPILLMAN.

The mule-footed hog differs in no important particular from the common breeds of swine save in the solid instead of cloven hoof. The foot character is probably made by the coalescence of the ungual phalanges. The metacarpals, basilar phalanges and middle phalanges are separate as in ordinary hogs. The claim of breeders that the mule-foot possesses hog cholera immunity is not borne out. Four such hogs at Indiana University died after exposure to this disease. The writer had gathered, though from study of but few specimens, that the foot character is on the whole disadvantageous, especially in heavy hogs. The breed is widely distributed in the United States, especially in the middle west and south, and two breeding associations for the registration of mule-foots have been formed. Evidence at hand indicates that solid-hoofed hogs have come down from ancient times, and perhaps the character has been found in certain strains of hogs since these animals were first domesticated.

In crosses between mulefoots and ordinary breeds the mulefoot character is more or less dominant. Some mixed-bred hogs have at birth solid hoofs which split apart usually at about nine months of age, and in some the rear toes split apart, while the front toes remain solid through life.

A Phylogenetic Tree Adapted for Use in Schools: W. P. Hay.

Professor Hay distributed large cards on which were printed botanical and zoological phylogenetic trees. The groups were illustrated by figures of a typical animal or plant with the enlargement or reduction indicated, and the figures of microscopical forms indicated by enclosure in a circle. He explained his use of the trees in teaching, and called attention to their defects and limitations as an expression of relationship. The subject excited general discussion.

The Migrations and Recent History of the Eskimo Curlew: W. W. Cooke.

The Eskimo curlew is almost extinct. Two were shot August 27, 1908, at Newburyport, Mass.; a few were reported by Dr. Grenfell on the Labrador coast the fall of 1906; Bigelow spent the entire fall of 1900 on this coast and saw only five birds and heard of about as many more. The last previous record in the United States is that of two at Nantucket, Mass., August 18, 1898, and the last specimen known from the interior of the United States was taken by Paul Bartsch at Burlington, Ia., April 5, 1893.

Yet this species was once exceedingly abundant. All writers from Cartwright in 1770 to Coues in 1860 testify to their enormous numbers in fall migration on the Labrador coast. Packard in 1860, speaks of a flock a mile long and a mile wide.

The Eskimo curlew had an elliptical migration route; it nested on the barren grounds of Canada, went southeast to Labrador and Nova Scotia, then straight south across the Atlantic Ocean more than 2,000 miles at a single flight to the Lesser Antilles and South America; it wintered on the pampas of Argentina and in spring went north by way of Texas and the Mississippi Valley in a narrow belt on both sides of 97°.

It retained its former abundance until the late seventies or early eighties and then in about ten years the species became almost extinct. Some of this diminution is probably due to the fact that during these years the part of the Mississippi Valley through which it migrated was largely brought under cultivation. But the most potent factor has been the changing of its winter home—where it spent one half the year on the pampas of Argentina—from sparsely settled grazing lands to enormous wheat lands. During the years 1878–1892 Argentina increased its wheat production fifty-fold and the pampas-loving Eskimo curlew suffered.

M. C. Marsh,
Recording Secretary

THE AMERICAN CHEMICAL SOCIETY
NORTHEASTERN SECTION

The ninety-fourth regular meeting of the section was held at the Twentieth Century Club, Boston, on October 22. Dr. W. D. Harkins, of the Massachusetts Institute of Technology, in an address upon "Smelter Smoke" described the nature and extent of the damage done by arsenic and sulphur dioxide emitted from the large copper smelters of this country, and commented on the various methods which have been tried for lessening these evils.

Dr. G. S. Forbes, of Harvard University, presented a paper upon "The Relation between Wave-lengths of Light and Photo-chemical Action." After summarizing the most recent experimental work in this field and stating the theoretical deductions, the speaker dwelt upon the vast opportunity for investigation offered in the study of the rôle of light in bio-chemical reactions.

K. L. Mark,
Secretary